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CASTING A STATUE OF HEROIC SIZE.

It would be a most difficult task to mention and separately describe each and every step which must be carefully noted by the operator in casting bronze in order that the resulting copy may be a facsimile of the original. Extended practice enables the founder to note all these features without necessarily appearing to devote more attention to one than to another; in a certain sense the work, from the melting of the metal to the final flowing, pursues a beaten path, along which are distributed certain guide marks, the absence or even the unusual appearance of any one of which quickly gives notice that all is not as it should be. It is here that we find a most apt illustration of the value of little things, since the most trivial neglect of a seemingly insignificant portion of the work may not only injure but destroy the casting.

Casting in bronze does not consist solely in simply taking a pattern, making a mould, and running in the metal; it is an art only to be acquired by long and patient toil, close study, and that most essential and spurring incentive, a fascination for the work. That success can only be achieved by this means will be understood by any one who will spend an hour in a bronze foundry, and note the time and care spent in making sure that one step is perfected before the next is even approached. There is no sign of the presence of that most pernicious habit, too frequently permitted in other callings, in which a distasteful part may be slurred or left half finished, and a rush made for something more agreeable. The bitter and sweet must receive the same attention, as both are equally dangerous when slighted.

One requisite qualification in the make-up of the bronze founder is an ability to obey orders. He receives from the sculptor a model in plaster which he is expected to reproduce in bronze; if he produces an exact counterpart, he has performed his whole duty, and has

strictly abided by his orders, which may be concisely expressed as "follow copy." It does not come within his province to attempt to improve upon the pattern set before him, but to reproduce it, whether full of blemishes or perfect. The artist does not expect him to improve his work.

Bronze statues were made two and perhaps three thousand years ago, the earliest consisting of small plates hammered into the desired shape and fastened together by nails or rivets. After this they were cast solid and also with a core. At the present time it is the general custom to divide the statue, when of heroic size, into several sections, make a separate casting of each section, and then unite the parts by riveting; the joint so formed, owing to the increased thickness of the metal, being of greater strength than the adjoining parts. But a great step in advance was recently made by The Henry-Bonnard Bronze Company, of this city, when they succeeded in casting, practically in one piece, Mr. J. Q. A. Ward's statue of the New England Pilgrim. The accompanying engravings (we wish here to acknowledge the kind courtesy of the general superintendent of the works, Mr. E. F. Aucaigne, for facilities extended to us) represent the "Pilgrim" as completed, the mould made ready for the metal, and a view of the foundry showing the position of the flask at the casting of the statue of the late Col. Wadley, of Georgia. This work is of interest because of the great difficulty attending each step, because it is the first time so large a single piece was ever cast, and because of the complete success reached. The Pilgrim was cast entire, with the exception of the head and right arm.

It is apparent that a statue used as a pattern will not draw; and in order to form a mould from it, it must be treated in a way very different from that in vogue in iron and brass

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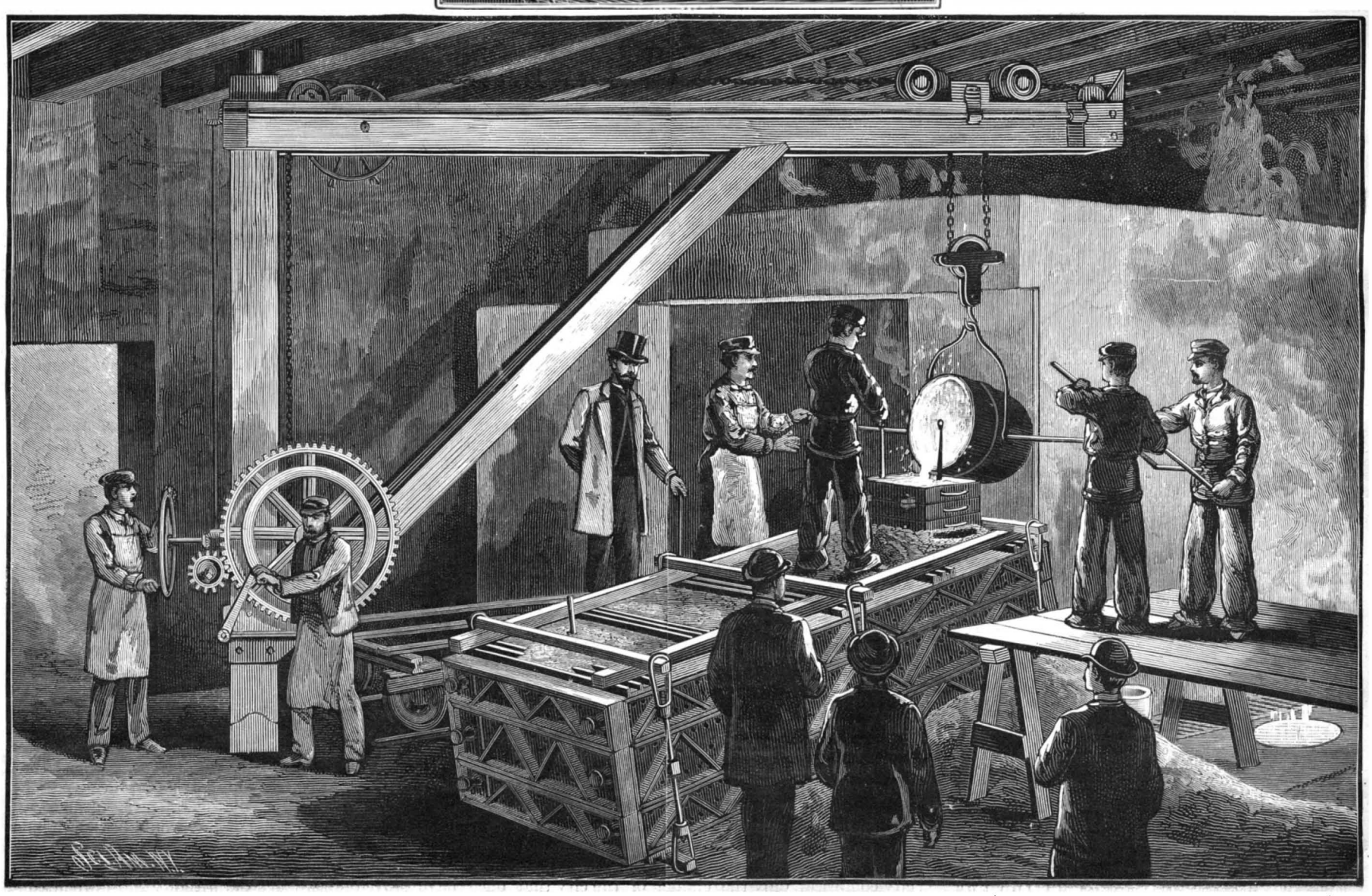

CASTING A STATUE OF HEROIC SIZE.

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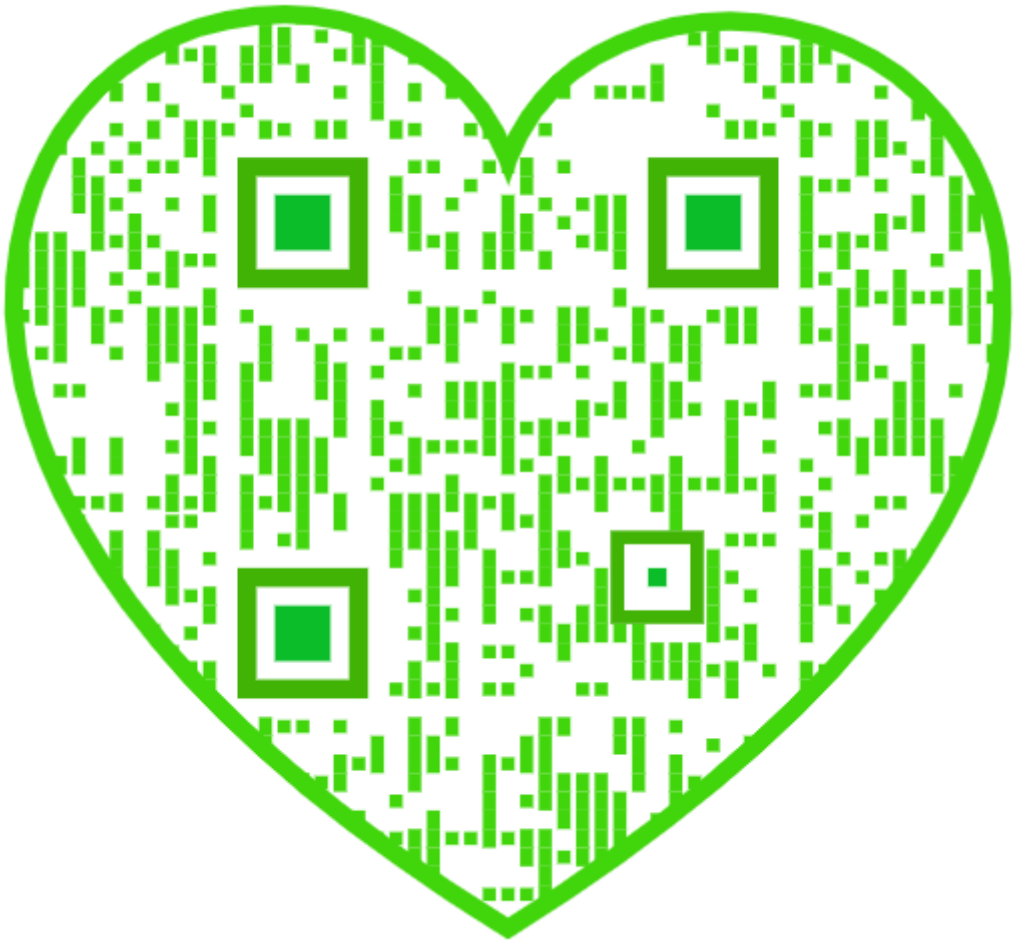

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CHANGES IN THE PATENT OFFICE.

Mr. R. G. Dyrenforth, of New York, Assistant Commissioner of Patents, has resigned the office, and Mr. R. B. Vance, of North Carolina, has been appointed to the same position.

During the recent brief interval between the resignation of Mr. Commissioner Butterworth and the appointment of Mr. Montgomery, the present Commissioner of Patents, the duties of that office devolved upon Mr. Dyrenforth, and he at once set to work to try to bring about a reform in the bureau, with a view to putting an end to the long delays in the transaction of business—abuses which Mr. Butterworth was unable to cope with. Under Mr. Dyrenforth's rule, brief as it was, there was a notable increase in the activity of the office.

Mr. Vance, the new Assistant Commissioner, was lately a member of Congress and chairman of the Committee on Patents. During his Congressional service he made himself very familiar with the affairs of the Patent Office, and took an active part in the House of Representatives in upholding the interests of inventors, at a time when hostile legislation was advocated by others. Mr. Vance is a man of much ability, and his acceptance of the office of Assistant Commissioner will, we think, be highly advantageous to the bureau.

HERAT.

Whether the Russian advance upon the northwestern frontier of Afghanistan shall be stayed at the mountains or pass on to Herat the coming summer, remains to be seen. In either case that ancient city will continue to be the center of the most commanding political and military interest. Sooner or later it must be determined, by skillful diplomacy or much fighting, whether Russia or England shall hold that time-honored key to Central Asia. Meantime all readers of telegraphic news from that quarter are asking for information touching the present condition of the city and its surroundings, and the reasons for its apparent importance from commercial and military points of view.

The geographical situation of Herat, 34° 22′ N. lat., 62° 9′ E. long., with its elevation of about 2,500 feet above the sea, gives it a charming climate. The valley in which it lies is the granary of Afghanistan, and its surrounding gardens yield fruits corresponding with those of Southern Europe. Central New Mexico has about the same latitude and a similar climate, though less temperate and somewhat drier. The plain of Herat is well watered by canals from the Heri River, and is said to contain fully 400 square miles of arable land. The upper valley of the Heri is described as a beautiful rolling country furnishing the finest of pasture lands. Three or four miles south of Herat the river is crossed by a magnificent bridge of 23 arches.

The territory tributary to Herat extends east and west from near the sources of the Heri to the Persian frontier, about 300 miles; formerly it extended north and south 200 miles from the Merv boundary to the northern limit of Seistan. The Russian conquest of Merv has cost Herat all its territory on the plain north of the Parapomisus Mountains, and has pushed the disputed boundary to within 40 miles of the city to the north, as the Russians claim, or about twice that distance according to the English and Afghan authorities.

The city is in the form of a quadrangle, nearly a mile on each side. On the western, southern, and eastern faces the lines of defense are almost straight, and are broken only by the great gates and their defenses. The northern line is broken by two gigantic earthworks, the old citadel and the new citadel, built of sun-dried bricks. The city wall rests on the summit of a huge embankment averaging 250 feet wide at the base and fifty feet high. The wall proper which crowns this vast earthwork is 25 feet high and 14 feet thick at the base. It is surrounded by a ditch 46 feet wide and 16 feet deep, and is supported by 150 semicircular towers.

The colossal character of these earthworks leads Sir Henry Rawlinson to infer that the city, as a stronghold, must date from prehistoric times—from that period of Central Asian history which preceded the rise of the Achæmenian power, and which in Greek romance is illustrated by the names of Bacchus, Hercules, and Semiramis. Its dominant position with reference to Central Asian and Indian affairs is proved by a military history unequaled by any other city—a record of more than fifty sieges, undertaken, as Vambery has pointed out, not so much for the sake of the rich soil which surrounds Herat, as on account of the desire for conquest with which it has inspired sometimes India, sometimes Central Asia.

The population of the city under these great vicissitudes of fortune has naturally varied greatly. In times of great prosperity and peace it has numbered a million or more; at other times it has dwindled to a few thousand; now, it is variously estimated from 25,000 to 50,000 or more. It is believed that the present city comprises only the citadel of the city that once covered the surrounding plain for many miles.

DO WE WORK TOO MUCH?

We have before us an interesting paper on "The Hygiene of the Nervous System," contributed to and reprinted from the *Alienist and Neurologist* by C. H. Hughes, M.D., of St. Louis. The belief expressed therein of a cholera visitation during the coming summer or autumn is supported by good authority, viz., the experience with former European epidemics, and the precautions suggested by the author are well advised and timely. He enumerates and describes the various physical and mental conditions which invite the infection in man and increase its virulence, among which he reckons engrossing and continuous application to business affairs. Dr. Hughes denounces a tendency he has discovered among Americans to "overwork."

He says: "The cause of much of the premature decrepitude and nerve degeneracy and breakdown of our day is in the many inventions man has devised whereby he robs himself of timely rest. The morning newspaper, often read through before breakfast; the telephone in his house to call him at any and all times aside from his repose; the electric light to keep his brain unduly stimulated through the retinæ; the railroad and the sleeping coach, which may keep him constantly on the rail (if he choses to so travel) for continuous weeks without rest from the noisy and exhaustive cerebro-spinal concussions of this mode of travel; hasty meals and telegrams, and business, and nightmare sleep, all commingled, wither and wreck lives innumerable, which, under wiser management, might end differently; and the needless noises of the city, the bells and steam whistles, howling hucksters, noisy street cars, yelling hoodlums, that make night hideous with soul-jarring sounds, hasten the premature endings of useful lives. And when, superadded to all this unphysiological strain, we have the assault of a pestilence that poisons, like cholera, how much exemption can such overwrought organisms expect? How much of resisting immunity can such overstrained and exhausted nerve force oppose to the invading foe?"

The question, How much resistance can an overstrained organism offer to the assult of the gruesome scourge? it is not for the lay mind, but for the medical faculty to consider. There is, however, good reason to believe that Doctor Hughes would find it impossible to prove that this "overwrought" condition is due to overwork. There are, of course, exceptional cases, but it is not with these we have to do, but with the broad assertion that we are an overworked people, and that "the cause of much of the premature decrepitude and nerve degeneracy and breakdown of our day" is begotten of overwork. Were we so bold as to express an opinion on the cause, we should say that it proceeded in great measure, if not in nearly every instance, from bad habits, from the immoderate use of liquor or other stimulants or irregular habits, or both, and in this assertion we could hope to be sustained by business and professional men of long experience, who have had the opportunity and inclination to study their business associates and employes.

Singularly enough, the Doctor, after informing us that undue excitement, anxiety, and overwork leave the system peculiarly exposed to and at the mercy of the infection, proceeds then to furnish us with evidence to disprove his own proposition. He says:

"During the week of the great St. Louis fire in 1849, the ravages of cholera, which up to that event had reached a mortality of over two hundred a day out of a population of fifty thousand, almost entirely ceased, so stimulating and invigorating was the excitement of that week to the brains and nervous systems of the people, the psychical exaltation inseparable from the sudden necessity thrown upon so many business men for repairing the sudden damage and re-establishing their abruptly interrupted business."

If the Doctor is sure about this, it would seem as though active employment, both mental and physical, furnished the best protection against cholera, and that the condition of nervous excitement and overwork which he most deplores as inviting the dire malady in reality presents the most effective barrier against it.

Among the many beliefs or rather superstitions which the light of recent investigation and experience has served to dissipate, is that which attributed a continuance of good health to a saving of the vital forces by inaction. A man was supposed to have a certain amount of vitality with which, as with his bank account, he could be saving or prodigal. Goldsmith, who besides being a poet was a doctor of medicine, and attended lectures in England, France, and Germany, only reflected the general belief in the doctrine when he tells us that he had hopes by a life of ease,

"To husband out life's taper to the close,
And keep the flame from wasting by repose."

His contemporary, Dr. Johnson, too, believed that the seven years of unceasing labor that he gave to his dictionary would shorten his life. There is reason to believe, however, that a life of ease would have hastened rather than postponed the demise of the former, and that Johnson's physical ailments would long before have proved unsupportable without the unremitting toil of which he so bitterly complains.

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The medical practitioner to-day advises exercise and fresh air where formerly he prescribed jalap, bleeding, and attenuations of aconite and belladonna, and the remedies of nature have been discovered to be more potent in the preservation of the health than any of the agents to be found in the pharmacopœia.

Nature, we have learned, is a careful economist who permits only those faculties or muscles to develop which are used; and as every faculty and muscle has a use, it follows that that condition is nearest perfect where all are employed, and, *per contra*, that inactivity leads to decay.

We hear much of the evils of "overwork," but see little of them in fact. Who has not seen those supposed to be overworked, who, in fact, never seem to be rid of their labors, grow stronger rather than weaker, the pallor begotten of inactivity succeeded by the glow of health, and the eye sparkle with fresh life?

Hard work hurts no one; it would not, perhaps, be saying too much to assert that those who have lived what are called "busy" lives have kept the vital spark longest aglow. In a little house in Beach Street, this city, we find John Ericsson, in his eighty-third year, studying from sunrise to sunset. Humboldt, who slept but little and worked incessantly, lived to 90, Newton to 85, Faraday and Agassiz to about 70. In France, M. Chevreul, the celebrated scientist, now in his ninety-ninth year, is still vigorous; and in England that eminent and honored philanthropist, Sir Moses Montefiore, an ever-busy workman, is still engaged in charitable schemes, though a century has passed over his head.

In Sailors' Snug Harbor, on Staten Island, there are more than 800 men, most of them aged, to whose careers of toil have been added the experiences and dangers incident to a seafaring life.

It is curious, indeed, to note how much those who have led active lives are capable of at that period when we are inclined to regard them as aged.

Though surrounded by a myriad of warriors, the great Agamemnon calls out regretfully to the aged Nestor on the field: "Ah, how I wish that thy stout heart were but supported by as firm a knee!" and the valiant Nestor responds:

"Yet, ancient as I am, I will be seen,
Still mingling with the charioteers,
Still prompt to give them counsel."

Various Forms of Tracing Paper.

A recent invention has for its object the rendering more or less transparent of paper used for writing or drawing, either with ink, pencil, or crayon, and also to give the paper such a surface that such writing or drawing may be completely removed by washing, without in any way injuring the paper. The object of making the paper transparent is that when used in schools the scholars can trace the copy, and thus become proficient in the formation of letters without the explanations usually necessary; and it may also be used in any place where tracings may be required, as by laying the paper over the object to be copied it can plainly be seen. Writing paper is used by preference, its preparation consisting in first saturating it with benzine and then immediately coating the paper with a suitable rapidly drying varnish before the benzine can evaporate. The application of varnish is by preference made by plunging the papers into a bath of it, but it may be applied with a brush or sponge. The varnish is prepared of the following ingredients: Boiled bleached linseed oil, 20 lb.; lead shavings, 1 lb.; oxide of zinc, 5 lb.; Venetian turpentine, ½ lb.; mix, and boil 5 hours. After cooling strain, and add 5 lb. white copal, 6½ lb. sandarac.

The following is a capital method of preparing tracing paper for architectural or engineering tracings: Take common tissue or cap paper any size of sheet; lay each sheet on a flat surface and sponge over (one side) with the following, taking care not to miss any part of the surface: Canadian balsam 2 pints, spirits of turpentine 3 pints, to which add a few drops of old nut oil; a sponge is the best instrument for applying the mixture, which should be used warm. As each sheet is prepared it should be hung up to dry over two cords stretched tightly and parallel, about 8 in. apart to prevent the lower edges of the paper from coming in contact. As soon as dry, the sheets should be carefully rolled on straight and smooth rollers covered with paper, about 2 in. in diameter. The sheets will be dry when no stickiness can be felt. A little practice will enable any one to make good tracing paper in this way at a moderate rate. The composition gives substance to the tissue paper.

You may make paper sufficiently transparent for tracing by saturating it with spirits of turpentine or benzoline. As long as the paper continues to be moistened with either of these, you can carry on your tracing; when the spirit has evaporated, the paper will be opaque. Ink or water colors may be used on the surface without running.

A convenient method for rendering ordinary drawing paper transparent for the purpose of making tracings and of removing its transparency, so as to restore its former appearance when the drawing is completed, has been invented by M. Puschers. It consists in dissolving a given quantity of castor oil in one, two, or three volumes of absolute alcohol, according to the thickness of the paper, and applying it by means of a sponge. The alcohol evaporates in a few minutes, and the tracing paper is dry and ready for immediate use. The drawing or tracing can be made either with lead pencil or India ink, and the oil removed from the paper by immersing it in absolute alcohol, thus restoring its original opacity. The alcohol employed in removing the first oil is of course preserved for diluting the oil used in preparing the next sheet.

Put ¼ oz. gum mastic into a bottle holding 6 oz. best spirits of turpentine, shaking it up day by day; when thoroughly dissolved, it is ready for use. It can be made thinner at any time by adding more turps. Then take some sheets of the best quality tissue paper, open them, and apply the mixture with a broad brush. Hang up to dry.

Carbon tracing paper is prepared by rubbing into a tissue a mixture of 6 parts lard, 1 of beeswax, and sufficient fine lamp black to give it a good color. The mixture should be warm, and not be applied in excess.

Saturate ordinary writing paper with petroleum and wipe the surface dry.

Lay a sheet of fine white wove tissue paper on a clean board, brush it softly on both sides with a solution of beeswax in spirits of turpentine (say about ½ oz. in half pint), and hang up to dry for a few days out of the dust.

Dissolving Rubber.

The solution of India rubber or gutta-percha in chloroform or benzole, frequently called for in photographic work, is usually attended with so many difficulties and drawbacks that, in nine cases out of ten, says the *British Journal of Photography*, where the solution is required the experimentalist usually purchases it ready made. Yet there need be no difficulty about the matter. First, pure rubber should be obtained—when vulcanized, it is perfectly insoluble. Secondly, pure solvents are necessary; chloroform containing a large excess of alcohol and water will fail to act even upon the purest rubber. Again, under the most satisfactory conditions, the action is very slow, and the amount of rubber capable of being taken up is proportionately very small. The plan usually adopted is to place a large amount of shredded rubber in a bottle, which is then filled up with the solvent, and shaken at intervals a few times; and when the shreds do not dissolve like pieces of sugar the whole is thrown aside, and we are written to for an explanation of the failure. If a small quantity of rubber had been placed in the bottle, and the liquid added, it would have been observed gradually to swell out very considerably after the lapse of some time, and a mixture of the whole would be facilitated by stirring with a glass rod or a splinter of wood. The rapidity with which the rubber absorbs the solvent will depend upon its condition; but the action is never very quick, nor is it in any way analogous to the dissolution of a crystal.

One cause of the failure of chloroform to act upon the caoutchouc may arise from the presence of alcohol in too great a proportion. Chloroform as sold almost always contains alcohol in small quantity, owing to the fact that when none is present it cannot be prevented from decomposing spontaneously, more especially in the light. It is, however, stated that when entirely protected from light absolute chloroform will not undergo any change.

A solution of gutta-percha in chloroform has a use which is not generally known. It forms when carefully made, and filtered quite bright, the best possible material for obscuring glass for focusing screens. For fine microscopic work it is said by those whose opinions are of weight to be unequaled.

A King's Workshop.

In a letter recently received from Burmah a characteristic sketch is given in illustration of the state of the country under its present ruler, in which it is stated that at Sagine there is what is called the king's workshop, which was erected at the instance of the last ruler at an enormous expense, his idea being to build steamers for his own and the country's use. The shipbuilding yard is at Mandalay, and the place at Sagine was designed as a foundry, in which cast and wrought iron was to be treated. Two large furnaces, fifteen boilers, three furnaces for cast iron, seven large engines, five rolling mills for bar iron, and a quantity of other machinery (including a large steam hammer, lathes, punching and shearing machines, and stone and ore crushers) have been put down. All that is required is to start the fires and raise steam; yet this valuable property is meantime overgrown with the products of the soil. The large steam hammer is twined round with beautiful crimson creepers; from out of one of the furnaces grows a large prickly cactus; the rolling mills are shaded with large tree ferns. The machinery, however, is not rusted, though nearly ten years have elapsed since the last king died. The works were suspended at his death, and the present king will neither spend more money on the undertaking nor sell it to others.—*Iron*.

Resuscitating Fish.

Mr. W. O. Chambers, secretary of the National Fish Culture Association, of London, conducted lately an interesting experiment in resuscitating fish by the use of brandy, before a number of gentlemen at South Kensington:

"Taking two Prussian carp from the tanks of the aquarium, he deposited them in separate dry cans, adorning one with blue ribbon to denote its enforced temperance principles and to distinguish it from the other, which was selected for the administration of spirituous liquors. After a lapse of four hours the fish were placed in water, evident signs of expiration being apparent in both cases. A small quantity of brandy and water was then given to the carp selected for the imbibition of intoxicating liquors, through the medium of a feather, and no sooner was the fish replaced in water than it assumed its normal condition, and seemed to be restored to vigor and strength. The carp enlisted under the banner of the 'blue ribbon league' to all appearances died half an hour after its more fortunate associate, and was taken out of the water and thrown on the ground. About four hours later, however, the fish was picked up by Mr. Chambers, who observed it by appearance to be *in rigor mortis*. He then at once operated on the seemingly inanimate fish by opening its mouth and pouring a dose of brandy and water down its throat, and again inserting it in the water, when, to his utter astonishment, he noticed slight signs of animation. For five minutes the unfortunate object of the experiment floated helplessly on its side, when presently, to the still greater astonishment of the secretary and those who watched the experiment, it gradually asserted itself in the water, and with considerable effort made use of its fins—feebly at first, but afterward energetically. Both the resuscitated fishes, which show no signs of their late prostration, now swim about with their *confreres* in the tanks as usual.

"The instantaneous reanimation produced in the carp in the first instance was indeed remarkable; but what can be said of the latter, which recovered after remaining out of the water for eight hours? Surely this discovery will prove of the greatest utility and value in restoring fish that would otherwise perish, and be the means of securing greater longevity among them.

"Experiments in relation to brandy as a means of restoring suspended animation with quick dying fish resulted equally as satisfactory. It was highly interesting to see the plucky manner in which a trout (*S. ferox*) battled with his fainting condition and came out the conqueror. Strange to say, the salmon (*S. salar*) did not once attempt to rouse himself after being dosed, the consequences being fatal to him; this was the only fish that succumbed under the treatment. The dace (*Leuciscus vulgaris*) was out of water three times of five minutes each. He was exceedingly faint and almost dead; but immediately after the brandy was given, he pulled himself together, and in the course of a few minutes not only recovered, but darted round the can with a rapidity positively amazing."

Compounds Formed by Chlorophyl.

Chlorophyl when isolated is very soluble in alcohol as well as in benzol or in petroleum ether. Leaves, either fresh or dried, however, do not give off their chlorophyl to petroleum ether, but merely a mixture of yellow or colorless matters. Hence it seems that the chlorophyl is contained in envelopes insoluble in petroleum ether, but soluble in alcohol. The deep green alcohol extract of dried and powdered leaves, if refrigerated, yields an abundant deposit of yellowish or colorless matter insoluble in petroleum ether. Chlorophyl is very unstable in presence of dilute acids, or even of pure water. It is very stable in presence of bases, behaving like a true acid. Hence M. Fremy gave the name of phyllocyanic acid to the green matter of leaves when freed from the accompanying yellow matters. With bases it forms definite salts; those of potassium and sodium being very soluble in water, but insoluble in absolute alcohol and in petroleum ether. The lead salt is insoluble. Chlorophyl may be found unchanged in the excretions of herbivorous animals, and even in peat.

The Telephone in Paris.

There has just been introduced in Paris a new system of telephone communication. The company issue tickets at five cents each. These tickets may be presented at any of the Paris post offices, and entitle the owner to hold five minutes' conversation with persons in any other post office or at any of the Telephone Company's stations. The Telephone Company offers, at the same rate, conversations at any of their eleven stations with persons at any other station or at the residence of any of their subscribers. For securing prompt medical assistance in cases of accident in the public streets, telephonic communication between the druggists and the hospitals in various quarters of the city is about to be established. By this means the nature of the accident and of the remedies or assistance required for its relief can at once be indicated.

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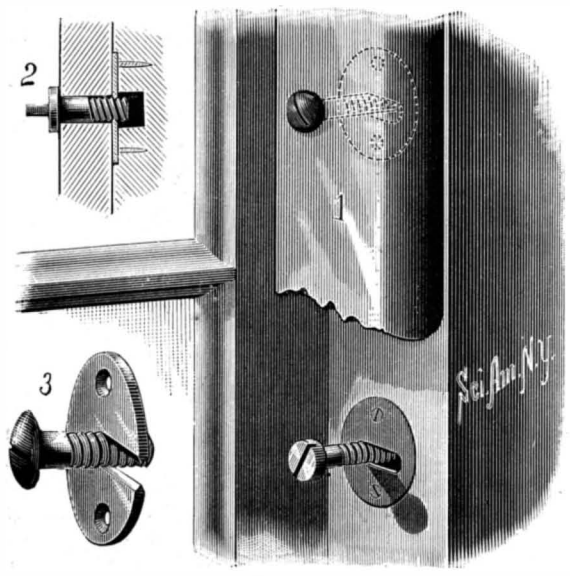
ADJUSTABLE WINDOW BEAD FASTENER.

On the window frame or casing behind the bead three or more metal plates or disks are secured, flush with the surface, and covering each a shallow recess. In each disk is a horizontal slot of suitable length, which receives the coarsely threaded point of a screw passing freely through the head, the slot being as wide as the thickness of the screw at the bottom of the threads. The edges of the slot are adapted to engage with the threads of the screw on opposite sides, thus forming a two-sided nut with straight threads, in which the screw may slide when loosened. The bead fastened to



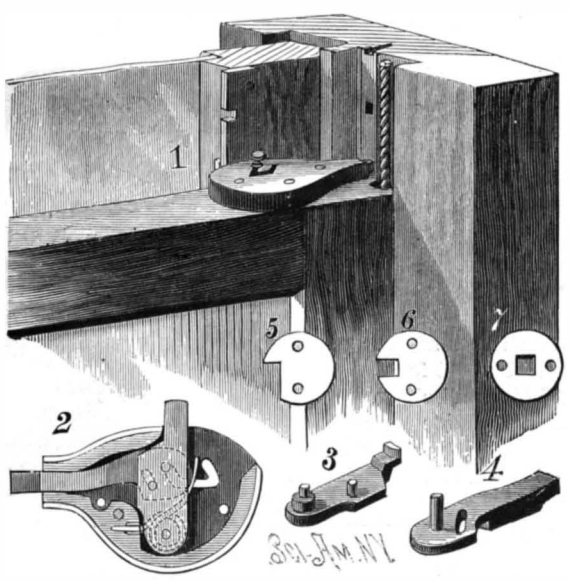
JOHNSON'S ADJUSTABLE WINDOW BEAD FASTENER.

these disks can be quickly adjusted toward or from the sash, to prevent rattling or binding, by a very slight movement of the screws without turning them out from the slots. The disks are cheap, and easily applied to any window; and the screws may be of the common kind, or have heads not needing a driver.

This invention has been patented by Mr. Edwin A. Johnson, of 104 Fayette Street, Allegheny City, Pa.

DOUBLE BOLT SASH LOCK.

The engraving shows a cheap and strong sash lock, recently patented by Mr. Edwin A. Johnson, of 104 Fayette Street, Allegheny City, Pa. The bolts are confined by a removable bottom in a casing secured on the top of the lower sash directly above the side rail. The swinging bolt is held at the inner end by a pivot, and at the free end has a beveled hook which engages with the edge of a notched plate on the upper sash, thus drawing the two sashes together. The sliding bolt enters an apertured plate in the window frame, and is moved by a pin projecting through a guide slot in the top of the casing. The two bolts are connected with each other by a sliding joint, consisting of a pin in a slot, and thus are operated together by the projecting pin and by a spring bearing on the inner end of the sliding bolt. At each end of the slot in the casing is a notch, which receives the projecting pin and thereby holds the bolts in place when drawn and when locked.



JOHNSON'S DOUBLE BOLT SASH LOCK.

Apertures at short intervals in both plates permit the sashes to be securely fastened when partly open for ventilation.

A NEW method of making chlorine has been described by *Le Genie Civil* as the invention of MM. Pechiney. It consists in the addition of magnesia to a concentrated solution of magnesium chloride, so as to produce a solid mixture, which is then treated with air and heat. Nearly the whole of the chlorine is liberated, a part as free chlorine and a part as hydrochloric acid. The residue consists of magnesia, which is used over again with a fresh charge of magnesium chloride.

A Valuable Train.

Perhaps the richest train that has passed over any road in this part of the country, says a Western newspaper, was that which went over the Hannibal & St. Joe one day recently. The train was composed of two cars of gold bullion, three cars of silver, eight cars of silk, and four cars of tea. The gold and silver were from Colorado, destined to the Philadelphia Mint. The silk and tea were from California, going to New York. A Pennsylvania paper, not to be outdone by the Westerner, claims that the *longest train* ever seen on the Lehigh Valley road was one that passed over that thoroughfare about the same time the *richest train* was coming East over the Hannibal & St. Joe road. It consisted of 123 eight-wheel coal cars, all loaded, and was drawn by a single engine.

Huge Locomotives.

Railroad	Brazil.	Southern Pacific.
Type of engine	Decapod.	El Gobernador.
Weight in working order, lb	144,000	152,000
Weight on driving wheels, lb	128,000	121,600
Weight of tender empty, lb	34,000	50,650
Water, coal, and tools, lb	46,000	35,000
Total weight tender, lb	80,000	85,650
Total weight engine and tender, lb	224,000	237,650
Tank capacity, gals	3,500	3,000
Coal capacity, lb	16,000	10,000
Cylinders, diameter and stroke	22×26	21×36
Driving wheels, diameter, in	45	57
" " number	10	10
Tractive force per lb. av. press. in cylinders, lb	279·6	278·6
Driving wheel base	16 ft. 11½ in.	19 ft. 7 in.
Engine wheel base	24 ft. 6½ in.	28 ft. 11 in.

It will be seen from this that the Decapod has slightly more tractive force, and is slightly lighter than El Gobernador. There is a singular difference in the tenders. El Gobernador's tender is 50 per cent heavier than that of the Decapod, but carries less water and coal. This is probably due to the fact that El Gobernador's tender has six-wheeled trucks.

One great difference, says the *Railroad Gazette*, between the two engines is in the size of the wheels. The Decapod's wheels are made as small as possible in proportion to the stroke of the pistons, and consequently the saving of weight effected by the smaller wheels and shorter cylinders enables the boiler to be increased to the unprecedented size of 64 inches diameter. The smaller wheels also enable a shorter driving wheel base to be adopted, the large wheels on El Gobernador nearly touching one another, though the wheel base is very long. In the Decapod there is room for two Westinghouse driver brakes on each side of the engine, and the wheel base is shorter, though still of considerable length for working round sharp curves.

The Decapod is a new engine, and the first with ten coupled wheels constructed by the Baldwin Locomotive Works for the wide or standard gauge, though two decapods, each weighing 90,000 pounds, have been built for the 3 foot gauge.

The piston rod is 4 inches diameter, and the main crank pins are 6 inches diameter. All the coupling rods have bushed ends. The Laird cross head is of cast steel, and the slide bars are cast iron. The boiler is fed by two long-stroke pumps and an injector. The reverse gear is a combination of screw and lever, so that either may be used.

The middle wheel of the coupled wheels takes the main rod. The two hind pairs and the front pair of drivers have flanged tires, but the main drivers and the pair immediately in front of the main drivers have plain tires.

The tender is fitted with a roof over the coal space, and is carried on two four-wheel trucks.

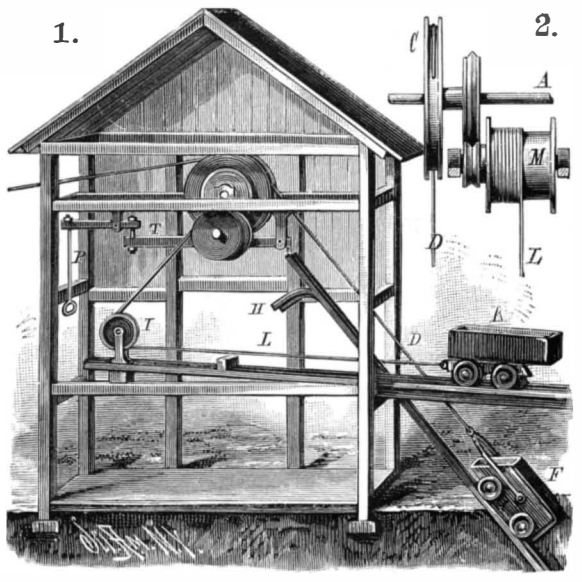
IMPROVED SLED.

The improvement in sleighs patented by Mr. Samuel Baum, Lock Box 66, Little Falls, N. Y., is particularly adapted for those known as "bob sleighs." The under side of the runner is formed with a longitudinal groove in which fits the rib of a steel shoe held to the runner by rivets or bolts. The forward ends of the runners gradually curve upward, and, at a point about on line with the raves, bend backward. These rearwardly bent ends are wider than the body portions, and are formed with flanges (as shown in the sectional view, Fig. 2), which bear against and protect the side edges of the raves; if desired, these might be extended so as to inclose the raves their whole length.

Just back of the flanged portions of the runners, the raves are joined by a sand board, and the rear ends of the runners are turned forwardly and upwardly and then inwardly, and secured to the under side of the sand board. Curved braces connect the runners and the under sides of the raves at their ends. A brace secured to the sand board extends to near the forward end of each rave. From about the center of each runner projects a brace having three branches, two of which are secured to the raves and the third to the sand board. The forward curved portion of the runner is supported at two points by branches of a brace secured to the rave and also to the sand board, as shown. This construction provides a sleigh which is thoroughly strong, which will last a long time, and not be likely to need repairs.

IMPROVED MINE RAILWAY.

The object of the invention herewith illustrated is to lessen the cost of transportation of ore, coal, etc., by utilizing part of the power of the hoisting car for operating a surface car. On a shaft journaled in the shaft house is mounted a grooved pulley, C, over which the hoisting cable, D, passes from the engine house down the inclined shaft to the skip, F, which runs on a track in the shaft and on a track extending upward from the shaft, and provided with a dump, H, near its upper end, where the skip is dumped automatically. Leading from the shaft house to where the ore is to be deposited



IMPROVED MINE RAILWAY.

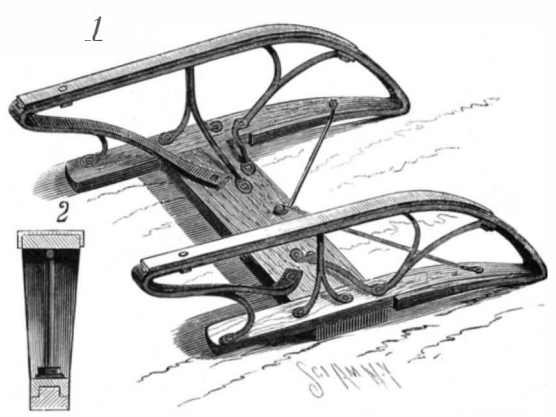
is an inclined track on which the dumping car, K, runs; this car is secured to a cable, L, which passes over the pulley, I, and winds about the drum, M. On the shaft carrying the drum is a grooved friction pinion adapted to be engaged with a friction wheel on the shaft, A. The drum shaft is journaled on a frame, T, one end of which is pivoted and the other end connected with a lever provided with the pulling rod, P.

As the skip is pulled up the incline the pulley, C, is revolved by the cable, D. Upon the rod, P, being pulled down, the frame, T, is raised and the friction wheels brought into contact with each other, thereby revolving the drum and drawing up the dumping car; by the time the dumping car is under the dump, H, the skip arrives at the dump and empties its load into the car, K. Upon the rod, P, being released, the frame moves downward enough to disengage the friction wheels, thus permitting the car, K, to run down. In the mean time the skip is lowered. In operation this arrangement would require only one man in any shaft house to run it, and would do away with all men and horses for tramming about a mine; neither would it require an engine and attendants.

This invention has been patented by Messrs. J. C. Fowle, J. P. Christopher, and W. P. Smith, and particulars can be obtained by addressing Mr. John C. Fowle, Michigamme, Mich.

Census of Occupations.

The census of 1880 gives the number of persons engaged in gainful occupations as 17,392,000, or 47·31 per cent of total persons over 10 years old. These were engaged in the four chief lines of occupation as follows: Agriculture, 7,670,000; professional and personal services, 4,074,000; trade and transportation, 1,810,000; manufacturing, mechanical, and mining industries, 3,837,000. In 1870 the number engaged in occupations was 12,505,000. Of those in 1880, 2,647,000 were women. The number of persons over 10 years of age is 36,761,000, leaving 19,369,000 unaccounted for. The latter number is about equal to the number attending school or physically incapable of labor. The census shows an increase over 1870 of about 30 per cent in population, but an increase of 39 per cent in the number engaged in occupations. This increase in number in occupations over the gain in population is accounted for by the growth of the factory system.



BAUM'S IMPROVED SLED.

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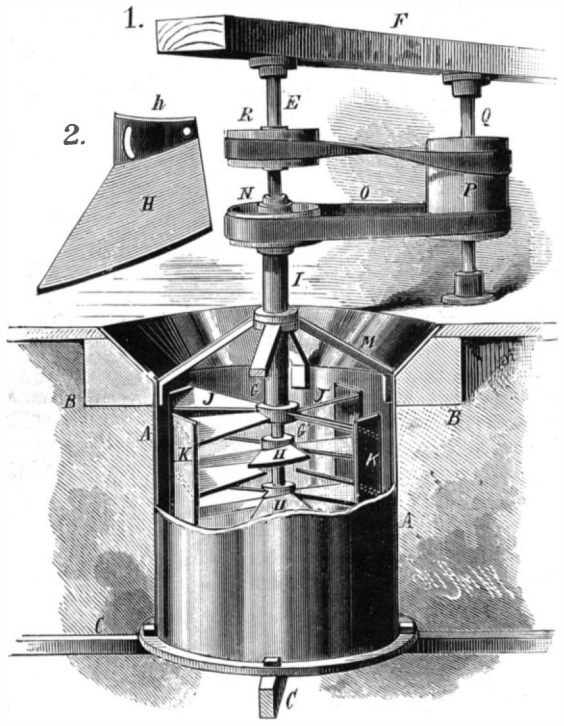
DOUBLE-ACTING WATER WHEEL.

The upper end of the cylindrical case, A, is flared to receive the water, and is attached to a suitable supporting frame, B, its lower end being secured to a spider or frame, C, in which is formed a central bearing to receive the lower end of the vertical shaft, whose upper end revolves in a bearing in the frame, F. To the shaft within the case are secured hubs, to which are attached the blades, H, the inner ends of which are formed with flanges, *h*, which are slotted to receive fastening screws, so that the inclination of the blade can be adjusted as desired. Upon the upper part of the shaft, E, is placed a tubular shaft, I, attached to the lower end, G, of which are the inner ends of the blades, J, whose outer ends are secured to the upright



RAU'S DOUBLE-ACTING WATER WHEEL.

bars, K. To these bars, below each hub, are attached the outer ends of blades, J, which are inclined in the opposite direction from the blades, H, and whose inner ends project nearly to the shaft. The lower part of the tubular shaft is centered upon the shaft, E, by a bearing formed upon the ends of the bars, M. At the upper end of each shaft is a pulley, R N, about which pass belts, O, leading to the long pulley, P, mounted upon the counter shaft, Q; one of the belts is crossed, as shown in the engraving.

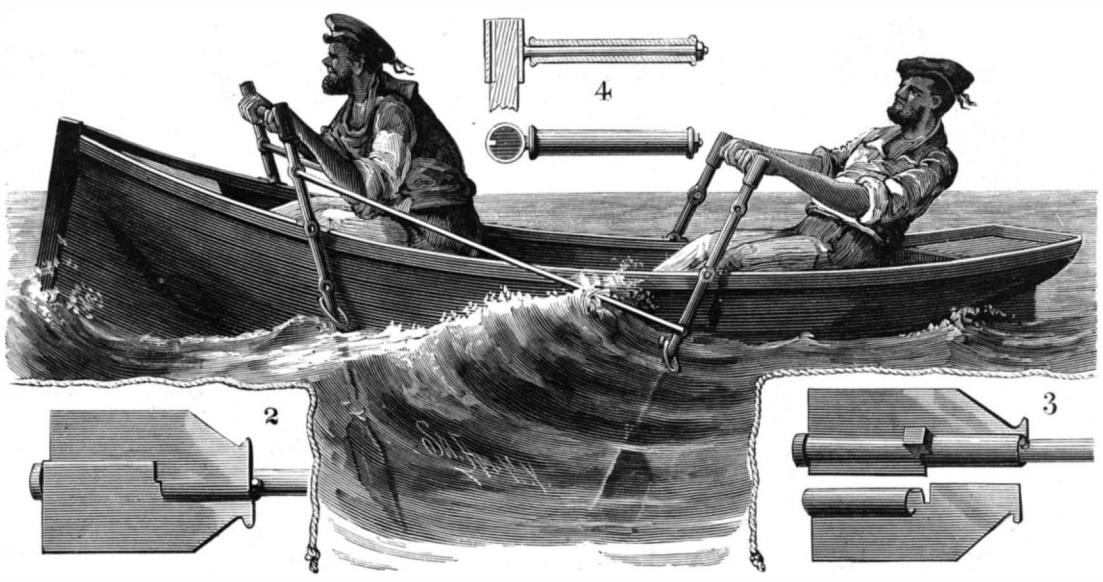
When water is admitted into the case, it acts upon the blades, H J, and revolves the shaft, E I, and pulleys, R N, in opposite directions, and these opposite motions, by means of the straight and crossed belts, O, act together to drive the pulley, P.

This invention has been patented by Mr. Charles W. Rau, of Allentown, Pa.

ROWING APPARATUS.

The main object of the invention herewith illustrated is to provide a rowing apparatus, whereby a boat may be propelled by fore and aft oars acting at opposite sides of the boat, and while the rowers look forward. Fixed to the shafts of the oars are pins which enter sockets of plates secured to the gunwale of the boat, so that the oars may swing fore and aft on the pins as centers. The blade of the oar (Figs. 2 and 3) is made in two wing sections, which have elongated eyes of about half the length of each blade. These blades are held on the oar shaft by a collar at the lower end, and are prevented from moving upward by a pin. On the oar shaft is a stud, against the sides of which strike shoulders on the wings when the latter are opened or lie in the same plane; and each wing is made with a side extension which bears against the outer face of the other. The stud prevents the folding of the outer edges of the wings closely together, so that at the beginning of the stroke they will open certainly and promptly, and the extensions form together an overlapping brace the full length of the blade, which may thus be made very light and cheap, and still have sufficient resistance on the pulling stroke of the oar. The oar handles (Fig. 4) are made with a long ferrule, having a feather entering a slot in the end of the oar shaft, and to which is fixed a rod carrying a hand roller. The handles extend thwartships, so that they may be conveniently grasped to work opposite oars. The oars may be worked separately or in pairs by persons facing the stern of the boat in the ordinary position; but the boat may be rowed forward by one or more persons facing the bow and by a pulling stroke. The two oars at the same side of the boat are connected, above and below their respective pivots, by a rod. The engraving represents the rods connecting with the bow oars at each side of the boat at points above their pivots, and with the stern oars at points below their pivots; so that, when the stern oar handles are pulled backward, their blade wings will be moved forward and will close, and the bow oars will be swung to carry their blade wings backward and open them for propelling the boat; when the bow oars are pulled, the actions are reversed. In other words, a pull on the bow oars gives the propelling stroke to the stern oars, and a pull on the stern oars gives the propelling stroke to the bow oars. The rings shown upon each of the oar shafts are used to prevent the opening of the wings when it is desired to use but one pair of oars; they are placed upon the upper parts of the closed wings beneath the lips, plainly shown in Figs. 2 and 3. When the boat is not in use, the oars may be held up at the sides by swinging the handle ends down toward each other and then passing the bent ends of a short rod into the holes of the oars nearest their handles. This apparatus allows the rowers to keep a sharp lookout ahead, and requires but little or no practice to use; the oars make no noisy splashing of the water, and the boat can be rapidly propelled and quickly turned.

This invention has been patented by Mr. B. Doscher, of 136 Meeting Street, Charleston, S. C.



DOSCHER'S ROWING APPARATUS.

Mother-of-Pearl Designs on Tissues.

A German has patented a design in Germany for producing mother-of-pearl designs on cloth by the following method: A thin layer of caoutchouc is spread over a thin copper plate, on which the design is cut. The cloth is spread over the plate, and a hot roller passed over it. By the heat the caoutchouc layer becomes liquid, and by the pressure it adheres to the cloth, on which the required design is thus obtained. The cloth is now covered with powdered mother-of-pearl, which is spread evenly by means of a hot roller, and the excess of mother-of-pearl which does not stick to the cloth is taken away by means of a soft brush. The cloth is now covered with very fine crepe which has been wetted in gum water, and, after drying, the crepe can be made fast on the cloth, so as to protect the mother-of-pearl powder from falling off, while, owing to its fineness and transparency, it does not spoil the brilliance of the powder.

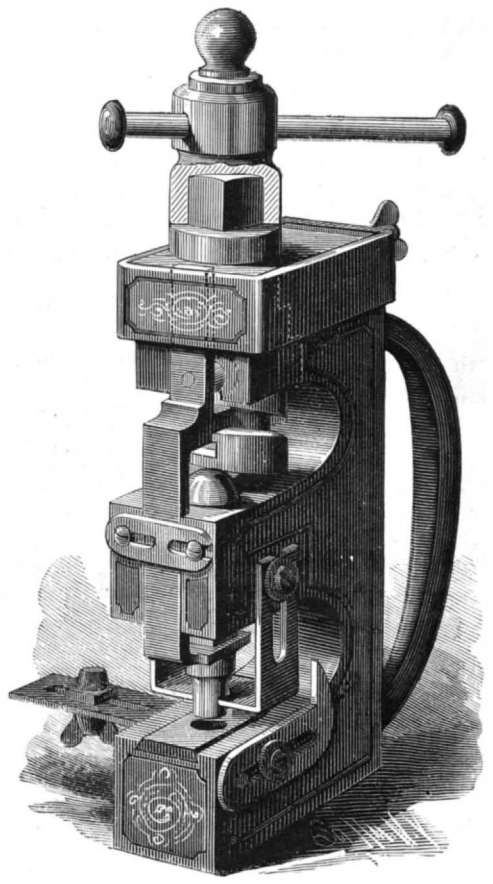
Oil from Soapsuds.

The saving arising from extracting oil from soapsuds is so great that no wool washer ought to allow his suds to run into the sewer in the form they leave the bowls. Tanks are prepared to receive the suds, and when a tank is full, a certain quantity of vitriol is poured into it. This causes the suds to curd or crack, and the grease and all solid matters fall to the bottom, leaving the water comparatively clean. This water is then run off down the drain, and the thicker portion at the bottom is afterward run into a filter bed of sand and gravel, through which the rest of the water gradually filters, leaving the solid and greasy matter behind. This is laid in cloths and called "puddings," which are pressed in hydraulic or steam presses till all the oil is squeezed out. From what is left, potash and other ingredients can be extracted, and the refuse is used as manure. The oil must be purified, and can then be used with great advantage for soap making or lubricating. As it is not worth while for each wool washer to do this for himself, it is advisable to sell the suds. The price, of course, is clear gain, especially when much greasy colonial wool is used

COLD IRON PUNCH.

The punch shown in the accompanying engraving is designed for the use of boiler makers, tank builders, and workers in tin, sheet iron, and brass generally. While promising the greatest amount of strength, the material is so distributed that none of it is useless.

The block or frame is provided with two recesses, between which a horizontal prong is formed, in which



THE ACME COLD IRON PUNCH.

the male die slides vertically. On the lower end of the die are projections resting on the prongs of a fork formed on the lower end of a bar sliding in grooves in the end of the block, the forked end of the bar being bent into the bottom recess. This bar is held in its grooves by a clip on the end of the horizontal prong and by a band surrounding the top of the block, and provided with a binding screw for clamping it on the block. The upper end of the spindle, held to turn in the end of the top prong, is formed with a square head, and on the lower end is a nut formed with a spiral groove into which a stud projects from the sliding bar. The bottom of the nut forms a spiral plane acting on the rounded top of the male die. The female die is dovetailed, and slides into a groove in the bottom recess. Held on the sides of the middle prong, as shown in the engraving, is a U-shaped frame having slotted prongs. This frame may be held at any desired distance from the female die. On one side of the lower prong of the block a gauge plate is held, and on the opposite is a slotted bar carrying a movable gauge, which can be locked by means of a winged screw. At the rear of the block is a handle for holding it. In the bottom edge of the front of a block forming half of the box for the spindle, and held on the outer end of the upper prong of the frame by the band, is held an anti-friction roller, on which the top edge of the spindle head runs.

The piece of metal to be punched, being placed on the female die, the spindle is turned, when the spiral plane on the bottom of the head acts on the rounded top of the male die, and forces it through the plate. The spindle then being moved in the reverse direction, the spiral groove in the head acts on the stud and pulls the sliding bar upward, this in turn pulling up the male die. The U-shaped frame prevents the plate from rising with the die. One revolution of the spindle accomplishes the work. The convenient form of this punch, which has been thoroughly tested with the most satisfactory results, will commend it to boiler makers, as it can be used in places where it has been almost impossible heretofore to punch with a machine, and less power is required to operate it, as none is consumed in overcoming friction. Further particulars may be obtained from the inventor and manufacturer, Mr. S. Coons, of Orbisonia, Penn.

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CASTING A STATUE OF HEROIC SIZE.

(*Continued from first page*).

founding. Yet this presents no obstacle to the bronze founder beyond now and then taxing his ingenuity. A piece mould is made of the plaster statue, the one we are about to describe consisting of more than 1,100 pieces. This piece mould is made of French sand, and is built up about three or four inches thick. When the statue has been completely covered, these pieces are separated and dried, and then reassembled, the space occupied by the statue being filled with sand to form the core. The pieces are again removed, and the core is pared down, the quantity of sand removed from the surface determining the thickness of the metal. The pieces are again assembled around this core, and then placed in the flask (shown in the large view), the space between the piece mould and sides of the flask being filled with sand packed tightly, when the metal is run in. Why there should be so many pieces in the mould will be readily perceived.

As an illustration, we may take the cavity in the ear, supposing it to be a conical opening with the base toward the interior. If we represent this opening by $\overset{3}{\underset{1\ 2}{\wedge}}$ we shall have a triangular cavity which it is necessary to fill with sand so disposed that it may be removed and yet be an exact imprint of the interior. The space marked 1 is first filled with a small trianglar piece of sand, and then the space marked 2. The adjoining faces of these pieces are so trimmed as to form a wedge-shaped opening, the base of which is toward the exterior. Since each piece within the cavity must pass freely through the opening marked 3, it may be necessary to fill the interior with many small pieces The sand forming each piece is thoroughly tamped as it is put in, to compact it, and make it retain its shape, and each completed piece is dusted, in order that its neighbor will not stick to it. Channels and indentations are formed in each piece, in order to insure their assuming the same relative positions whenever reunited. In this way all depressions in the mould are filled with small pieces varying in size from that of a pea up. When the statue has been completely covered, these pieces are removed and carefully dried. They are then reassembled, and the interior filled with sand packed tightly. They are again taken apart, to allow the core to be trimmed down. To distribute 1,100 small and large pieces of sand, and remember where each piece belongs—for in putting them together there must be no squeezing to force a fit—is a task of no small magnitude.

The exterior of the core is removed, the thickness of the layer taken away representing the thickness of the metal in the statue. The mould is then built up around the core, which, in the case of the Pilgrim, was supported at the feet, the neck, and at the right shoulder. This formed a narrow space between the core and mould to receive the metal. The space separating the core and mould is as thin as it can possibly be made and yet insure a complete distribution of the metal. The main object to be accomplished by this is to effect a rapid cooling, in order to hasten the setting of the metal, to prevent a separation of the tin and copper, this being likely to occur, owing to the wide difference in the fusibility of the two metals.

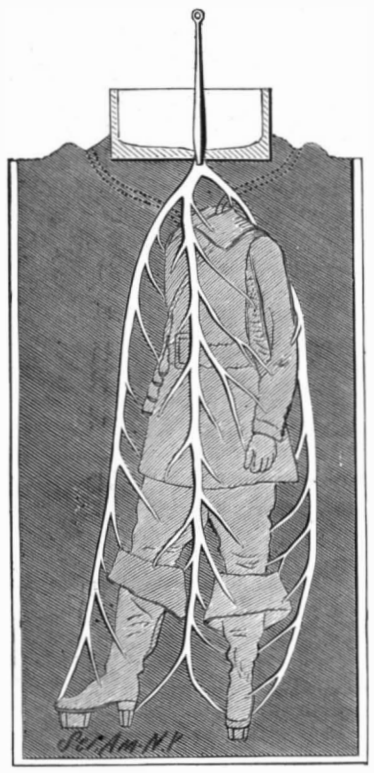
By means of gates, resembling somewhat a tree and its branches, as will be seen from the engraving upon this page, the metal is conveyed to every part of the mould. Three large or main gates lead down the back and sides of the figure, and from these extend the short branches, this insuring a rapid flow of the metal to every part of the mould. Passages are provided for the escape of gas, and within the core are placed "lanterns" formed of tin tubes designed to receive the gas formed in the interior.

The Pilgrim was cast in an upright position. On top of the flask was formed a reservoir capable of holding about 1,000 pounds of metal. In the bottom of the reservoir was an opening leading to the gates and closed by an iron plug. At each side of the reservoir was an opening into the mould, designed as an overflow, to show when the mould had been filled completely. The copper is melted in large crucibles, the tin being added afterward, the proportion here used being 92 copper to 8 tin. The reservoir being filled, a large crucible holding about twice as much more is brought by the crane until its contents can be poured into the reservoir. This great quantity of metal is required, since the bronze statue—9 feet in height—weighs nearly 2,000 pounds.

It is at this stage that one of the most delicate and important features in the whole work makes its appearance, and one upon which success directly depends. All hands wait until, in the judgment of the foreman, the bronze is at the exact temperature to insure a perfect flow. Too high or too low a temperature would ruin the casting. The men, who have that pride in their work which makes them as interested in the result as the proprietors, wait, ready to obey quickly and implicitly the orders given them. At the proper moment the plug is withdrawn from the reservoir and the crucible tipped. Pouring is continued until the metal flows out at the overflow holes, when it is known that the casting has been successfully performed. When cool, the statue is removed, the gates cut away, and the seams trimmed. The head, arm, and pedestal being joined to the body, the work is finished.

In casting the statue of Col. Wadley, the second one ever attempted in this way, the flask was placed at an angle, so shown in the frontispiece, the reservoir being at the upper corner.

The success attending these efforts is due to the experience and skill of the men, all of whom have been years in the business. The extreme care and attention they devote to every detail shows the great interest they feel in their work. The foundry is in charge of



CASTING A STATUE OF HEROIC SIZE.

Mr. John Pischof, while the finishing shops are under the control of Mr. Th. Lorme, both of whom have been for many years connected with bronze casting.

Sorghum.

At a recent meeting of the New York Chamber of Commerce, Dr. Peter Collier, who has made a special study of the cultivation and uses of sorghum, made an address, from which we extract as follows:

The history of sorghum with us only dates back to 1853, when William R. Prince imported from France a little sorghum seed, which Mr. De Montigny, the French Consul at Shanghai, China, had sent to the Geographical Society of Paris in 1850. In 1857 Leonard Wray, an English merchant, brought from Natal, South Africa, sixteen varieties of sorghum seed. To these last the name imphee was given, while the former was known as the Chinese sugar cane. And yet this plant, whose merit as a sugar producing plant appears to have been recognized thirty years ago, had come to be regarded as mainly valuable for forage or as a source of an inferior quality of syrup. It was a great error obtaining in Great Britain and on the Continent, as also in our own country, that the East Indians were a rice-eating people. Fully nine-tenths of them subsist mainly upon sorghum seed. In Turkestan sorghum is the main cereal, as, owing to the excessive droughts, no others could be successfully grown. In the northern part of China, sorghum was grown as maize is with us, and for the same purposes, and it so entirely satisfied the wants of the people that it had practically excluded maize. I have personally obtained within a few months from Calcutta eleven varieties of sorghum seed, twenty-one varieties from the Dharwar district in Western India, three from Hong Kong, three from Foo Chow, two from Senegambia—in addition to eight varieties from Northern China, three from Cawnpore, India, and twenty-two from Natal, South Africa; in all, seventy-three distinct varieties of sorghum—not one of these appearing to be identical with any of the numerous varieties cultivated in the United States; and it is to be remembered that none of these varieties has ever been cultivated in either of these countries for any purpose other than the seed and such forage as might be secured from the stalks and blades. Indeed, it is probably true that for the past thousand years the seed of sorghum has furnished food in greater abundance for both man and beast than have wheat and maize combined.

It is admitted that the demands upon climate and soil of the sorghum, as also the details of cultivation, are practically identical with those of maize, although it is a matter of moment that the sorghum, provided only it secures a good start in the early portion of the season, is capable of withstanding not only, but even flourishing during a drought which would prove fatal to maize. The chemical composition of sorghum seed shows it to be practically identical with maize; and for the purposes of food, or fattening, for the production of alcohol, glucose, or starch, the one may be substituted for the other, and there is no reason for any difference in their commercial value. Grown as Indian corn is grown, for the seed alone, sorghum is a crop of equal value with corn, and we are prepared to believe that upon a plantation properly located with regard to the mill and with economy in management, the seed will pay the entire expense of cultivation of crop and the delivery of the cane at the mill, as one of our largest sorghum planters has assured me.

It will be seen from tables which I present that the average amount of available sugar present in the juice actually expressed, from a crop actually grown, equaled 1,960 pounds per acre, while the amount of available sugar actually present in the crop, on the supposition of 90 per cent of juice, was an average of 2,853 pounds per acre. These certainly are astonishing results, and since they have been published, there have been, in certain quarters, persistent and continuous efforts to cast discredit upon them, despite the fact that a committee of the National Academy of Sciences (our highest scientific authority) had unanimously indorsed the methods by which these results had been obtained as being "among the best known to science."

The bagasse from sorghum contains not only a large amount of sugar, but other valuable food constituents, and it is, as it comes from the mill, in a mechanical condition admirably adapted for the silo and for eating. It appears from averages of a large number of analyses, that the actual money value of bagasse for food is almost exactly double that of ordinary ensilage; and since many of our farmers are engaged in preparing and feeding ensilage, it is worth while for them to consider the value for this purpose of the bagasse of the sorghum mills, at present used as fuel or for the manure heap. The bagasse, from which the sugar had been thus removed, was afterward submitted to the ordinary process for the preparation of paper pulp, and a sample was made, which, upon being submitted to one of our largest paper manufacturers, was pronounced to be of excellent quality, and worth four and a half cents per pound. A ton of cane would yield at least ninety pounds of such pulp, so that, with an average of ten tons to the acre, there might be made an amount of pulp worth $40.50. It is to be considered that each step in the process to which the cane is subjected increases its value for the production of pulp, and as there is nothing in the treatment which forbids its economical employment upon hundreds of tons of exhausted bagasse, there is reason to believe that ultimately this industry may be added to the production of sugar from sorghum cane, thus utilizing a waste product and increasing the profits on the crop. I think, therefore, that it may fairly be claimed for sorghum, from the facts which have been presented, that we have in it a crop fully the equal of Indian corn for its seed, and, in its stalks, fully as rich in sugar as is the sugar cane of Louisiana, and, besides, furnishing, in its bagasse, a material for the silo twice as valuable as common ensilage for food, or which bagasse may, by diffusion, yield at least an average increase in sugar and sirup of fifty per cent over that obtained by the mill, and then furnish to the manufacturer of paper excellent material for pulp.

Alleged Successful Treatment of Hydrophobia.

A native surgeon, M. Nursimula, has written a letter to the editor of the *Times of India*, from which it would appear that he has treated successfully a case having all the symptoms of hydrophobia. The treatment adopted was the subcutaneous injection of a sixteenth of a grain of atropia. The breathing became infrequent (12 per minute), and the pulse slowed to the rate of 50 per minute. A quarter of a grain of morphia was injected hypodermically as an antidote to the atropia, and this was repeated several times. The symptoms disappeared the third day after the onset of the malady. The patient was a soldier, aged twenty-four, who had been bitten by a dog the week before the symptoms resembling hydrophobia appeared. If the case were one of hydrophobia, it must be allowed that the period of incubation was very short; the dog is not stated to have been mad, and it must not be forgotten that the presence of symptoms closely resembling, if not identical with, hydrophobia does not *prove* that the case was one of genuine rabies.—*Lancet.*

Lead in Enamels.

A very rapid and handy mode of testing the enamel or tinning of cooking vessels, etc., for lead is recommended by M. Fordoz. The vessel is carefully cleaned to remove all grease, etc. A drop of strong nitric acid is then placed on the enamel or tinning, and evaporated to dryness by gentle heat. The spot where the action of the acid has taken place is now wetted by a drop of solution of potassium iodide (5 parts iodide to 100 of water), when the presence of lead is at once shown by the formation of yellow lead iodide. Tin present in the enamel, etc., does not give a yellow spot when the potassium iodide is added, the stannic oxide formed by the nitric acid not being acted upon.

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A One Wheel Watch.

A curiosity in the way of watches was shown by Mr. E. Sordet, director of the Watchmakers' School at Geneva, before the horological section of the Society of Arts. This wonder is nothing less than a watch with one wheel, manufactured at Paris, in the last century, by a Mr. Gautrin. The watch was presented to the National Institute in 1790, being then in a deplorable state; but the teacher of the repairing section at the school, Mr. Emile James, has, after many hours of labor, succeeded in re-establishing harmony between the various organs, so that it is now in going order. The great wheel which gives the watch its name occupies the bottom of the case and the center of the plate; it has 60 teeth, and is 33 mm. in diameter. Its axis carries two pinions, one of which receives the motive force from a barrel, and the other carries the minute work. The function of this great wheel is quadruple. First it acts on a lift, then on a lever operating on another destined to lower the axis of the watch, and lastly on a third lever, the latter serving to return power to the great wheel at the moment when the action relents by the rise of the axis.

Value of Patent Property.

An illustration of the worth of a first class patent, for a device that everybody wants to use, is seen in the Bell telephone patent. The committee of three appointed by the Ohio Legislature to investigate the telephone companies in Ohio have prepared a report in which they say that there are about 12,000 complete sets of instruments in use in the State, all owned and controlled by the American Bell Telephone Company, of Boston. These instruments are leased to the local companies at an annual rental of $20 for each set, making the annual tribute paid by these local companies over $200,000. The cost of each set of instruments did not exceed $3.35. On instruments which did not cost the Bell company over $40,000, it receives over $200,000 annually. The Bell company, before granting a franchise to a local company, exacts from 30 to 35 per cent of the stock of the local company and from 20 to 25 per cent of the gross earnings of all toll lines. The committee declares that in its judgment the Bell company is an imperious and unconscionable monopoly, and should be restricted by legislation, or at least be taxed upon the commercial value of its instruments, and that it should be required to pay, in addition to the taxes upon its instruments, a tax upon gross receipts.

A new industry was created when the Bell telephone was invented, and great ability has been shown in the administration of the company's affairs from the commencement. To these facts the large profits are greatly due. Had the company's affairs been less wisely managed, probably it would not now figure before the Ohio Legislature as an "unconscionable monopoly," fit only to be plundered by the tax gatherers.

A Great Blast.

The San Francisco Bridge Company recently made a large blast with a view of obtaining 90,000 tons of rocks for constructing a sea wall at San Francisco. The quarry is a bluff, 60 feet high, at the water's edge at the mouth of Visitation Valley. Eleven tunnels in all have been run and four have been exploded, 11,000 pounds of Judson powder being used. Each tunnel was 50 feet long, and extended to an L, in which was the powder. From the L to the mouth of each tunnel rock and dirt had been "tamped" in as hard as possible. The four explosions were to occur successively, the first to loosen the cliff and make it easier for the second to become effective, and so on. The first explosion was awaited with some little apprehension by the harbor commissioners and other occupants of the towboat. But when it occurred, with a dull, heavy sound, and it became apparent that fragments of stone were not to fly through the air, there was a unanimous desire that the boat should move nearer the shore. The other explosions occurred soon after. No. 3 was a grand affair. A great section of the cliff was toppled over, and huge bowlders and tons of dirt rushed down to the water's edge. The blasts were pronounced successful, and the quality of stone, on subsequent inspection, seemed satisfactory to the harbor commissioners. It was estimated by the engineers that the 11,000 pounds of explosives had displaced in about 10 minutes 35,000 tons of rock and earth.

Spontaneous Combustion of Lampblack.

Fires occurring from spontaneous ignition of vegetable black are very common. Oily rags are more liable to self-ignition during the summer after a continuance of dry, warm weather. A sudden storm or a shower of rain appears to give life, as it were, to the parched-up matter, and a fire is the result. It has been also noticed that the reverse occurs after a continuance of wet weather. A few days sometimes are sufficient to set up active and rapid combustion, especially among sweepings in paint and oil stores, consisting generally of wood dust, dried vegetable and animal powder, colors more or less saturated with varnish, turpentine, oils, etc. Lampblack, if packed in a leaky cask when freshly prepared, condenses the atmospheric gases on its surface, which, owing to the porous nature of the substance, is very large in proportion to its weight. In condensation the gases give out a certain amount of heat, which under favorable circumstances is sufficient to cause the ignition of some inflammable substance accidentally present, which, by combining with the condensed oxygen, liberates heat enough to cause the ignition of vegetable black, which, when once started, soon spreads until the contents of the cask become red hot.

This spontaneous ignition is not infrequent in many large carriage factories, and builders' shops have been destroyed solely from this cause. To put it in printed paper would insure ignition from the absorption of the oil in the printing ink by the lampblack, generating gas which would soon ignite the soot or lampblack. One among many instances of well attested cases of spontaneous ignition is described in the *Paint, Oil, and Drug Review.* It occurred at a large carriage works at Grantham, England, in a shop far away from fire or the chances of a spark. The paint shop was gradually illuminated on a mild summer's evening during daylight. It was noticed through the workshop windows, and seen to be a tub of loose lampblack slowly consuming the cask. It was easily carried out on to the grass to finish its work. It was thought that, being near the grinding-paint stone, some oil had been splashed into it, or an oily rag dropped into the lampblack. The secret was soon found out by the palette knife being found among the ashes of the cask, having been carelessly dropped in with some wet paint on it; or even without any wet paint, the dry, oily paint which accumulates on the blade near the handle would be sufficient to cause ignition. It is not the large quantity of oil, but the small quantity, which is the cause of it. This is so well known, that some coach makers, when they receive lampblack, put it into a sound cask and pour enough linseed oil into it to saturate the whole.

AN ELECTRICAL STANDARD FOR MEASURING LIGHT.

Our large engraving represents a new form of arranging an incandescent electric lamp with reference to its use as a standard light for photographic purposes, and is the outcome of a long series of experiments by Mr. Thomas A. Edison and his assistant, Mr. John Ott, in charge of Mr. Edison's laboratory.

The problem of obtaining a steady light and a uniform current from a variable battery, with lamps of varying resistances, has been a puzzling one, but has recently been very ingeniously overcome; and it is our purpose to relate some of the incentives which led Mr. Edison to reach the result obtained.

During the past winter months the officers of the Society of Amateur Photographers, of this city, undertook to invent or provide some form of standard light which could be depended upon, to be used in testing the sensitiveness of different brands of gelatino-bromide dry plates. It occurred to them that possibly Mr. Edison might devise a uniform electric light, the actinic qualities of which, it was well known, would be invaluable for the kind of work to be undertaken.

The strength of the light required was to be equal to one candle power. When the matter was first introduced to Mr. Edison, he was of the opinion there would be no difficulty in obtaining a means of accurately measuring and controlling the resistance of such a small lamp, if a battery was employed.

The original plan was to interpose a known resistance in the main circuit with the lamp, which could be varied, and also an amperemeter or a voltmeter for measuring the variations of the current; but, after a large number of experiments, it was found impossible to make an instrument delicate enough to accurately measure the very low resistance in the lamp, which is said to be equal to about three-fourths of an ampere.

Mr. Edison then turned his attention to the utilization of the electrical compensation balance invented a few years ago by Prof. Poggendorf, which is generally recognized as being the most delicate method of measuring electro-motive force of batteries, and at the same time has the advantage of being entirely free from any detrimental polarization.

In this method of measurement the currents from two batteries are so balanced by the insertion of a variable resistance that, if a galvanometer is inserted in the circuit, no traces of a current can be perceived.

The arrangement as shown consists of a standard constant battery, a galvanometer, a key, a rheostat or resistance wire made in two sections, two parallel brass rods arranged directly above each section of the wire, provided with adjustable collars, which connect the bars to the sections of wire, and a switch, all fixed upon a base which rests upon a photometric testing box. Within the latter, supported upon a sliding board, is the standard electric lamp.

Hinged to this board is a long wood rod, which when the side of the box is closed, as it is intended to be for actual work, permits the operator to move the lamp at the open end to different distances from the sensitive plate, held in a plate holder slide, shown at the opposite end. The lamp is connected by flexible cords to the binding posts leading to the main battery and one of the sections of the rheostat wire.

The apparatus is intended to be used in the photographic dark room. The cell of the standard battery, S, is the standard by which the electro-motive force of the Fuller, or main lamp, battery, M, is measured.

The battery, S, which is comparatively new, was devised by Mr. Geo. Wirt, who is connected with the Western Electric Mfg. Co., of New York, and is a modification of the well-known Daniell battery. It is so constructed that the fluids cannot become disturbed or mixed through any slight jarring. It consists of three square bottles, 1¼ inches square by 4½ inches high, with a neck ⅞ of an inch in diameter by 1 inch long, securely clamped together with metal screw rods at the top and bottom, and held in an upright position by a light wood framework, as shown in the engraving. In the upper part of the adjoining sides of bottles I. and II. is drilled a small hole ⅜ of an inch in diameter, and in the lower part of the adjoining sides of bottles II. and III. are similar holes, all arranged to correspond with each other.

A soft rubber washer separates the bottles at the holes, making a water tight joint, and also acting as a support to hold in place a thin film of gold-beater's skin, through which the liquids must pass by the process of endosmose and exosmose, from one bottle to the other.

All of the bottles are filled with a dilute solution of sulphate of zinc; within bottle I. is placed a piece of sulphate of copper about the size of a pea, which changes the solution to a blue color; the copper electrode at the bottom is connected by an insulated wire, which passes through the cork to the back of the key, K. At the bottom of bottle II. is a small chunk of zinc, which collects any deposit of copper, should any pass through from bottle I.

In the top of bottle III. is suspended the zinc electrode, which measures about 1⅛ inches long by ¾ wide and ⅛ thick; its conducting wire as shown passes directly to the galvanometer, G.

It will be noticed this arrangement gives a very constant battery which cannot polarize, as each electrode is completely isolated, and the separation of the bottles with the gold-beater's skin also prevents an easy mixture of the solutions. Each electrode is never endangered, but is kept immersed in a solution favorable to retain it in perfect condition.

The main or Fuller battery, M, has been somewhat modified, but consists of a zinc electrode inserted in the porous cup, in which has been placed a teaspoonful of mercury and a dilute solution of sulphuric acid and water.

In the glass jar are four carbon rods about one inch square, arranged to fit in each corner of the jar, connected by a ring of wire at the top to one conducting wire, which passes out through the top of the cell. The jar is filled with the usual bichromate of potash solution, known as electropoin. A metal screw cap secures a rubber cover to the top of the jar, and thereby prevents the evaporation of the solution. Six cells are employed, and are plainly seen, located on a shelf at the right, in Fig. 1.

The amount of resistance inserted in the series is a trifle more than the resistance of the lamp while hot, and consists of a length of 5½ feet of German silver wire $\frac{16}{1000}$ of an inch in diameter, divided into equal sections connected together at one end, as seen in the diagram of Fig. 2, near the key, K, by a metal link. One section lies upon the millimeter scale parallel with and directly under brass rod No. 2; the other also lies on the board under brass rod No. 1. The section of resistance wire under rod No. 2 is electrically connected thereto by a hinged metal pointed foot and adjustable collar, which may be adjusted to any point on the rod over the millimeter scale, and is secured by a set screw. The position of this collar is never changed except when a new lamp is to be inserted in the circuit. The section of resistance wire under rod No. 1 is electrically connected to the latter by a sliding collar provided with a spring, at the end of which is a grooved brass wheel about ⅜ of an inch in diameter, which bears directly upon the wire.

In the diagram, Fig. 2, the arrangement of the apparatus will be seen more clearly. S represents the "standard battery," G the galvanometer, No. 2 brass rod with fixed collar, No. 1 brass rod with movable collar, R resistance wire, which also connects with wire under rod No. 2, K key in the circuit of standard battery, L the electric lamp.

In order to intelligently understand the operation, we will detail the two different circuits of the batteries.

The circuit of the Fuller battery, M, is from the positive or carbon pole of the battery to brass bar No. 1 (see Fig. 2), through the collar, spring, and wheel to the German silver wire, R, to the lamp, L, and then back to the negative or zinc pole of the battery. It will be seen that by sliding the collar on rod No. 1, the amount of resistance in this circuit is easily increased or diminished.

The circuit of battery S is from the positive or copper pole through the key, K, to the resistance wire, R,

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thence through the pointed foot and fixed collar to brass bar No. 2, through the galvanometer, G, and back to the negative or zinc pole of the battery.

In the lamp circuit a switch is inserted for turning the current on and off when testing.

It will be noticed that there is a section of the resistance wire, R (the amount between the end connecting with key, K, and the pointed foot under rod 2), through which the current from each battery flows; and although the current from the main battery, M, has a circuit in

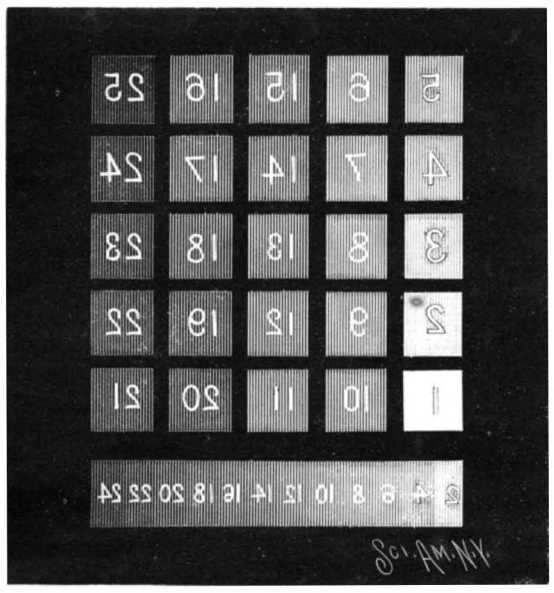

Fig. 3.—SENSITOMETER SCREEN.

dependent of the galvanometer, it is in this section of wire that both currents are brought into juxtaposition and the electro-motive force of the main battery compared with that of the constant battery, S. The variation is at once noticed on the galvanometer, and is easily regulated, as will be hereafter described.

In operating the lamp, the switch in the lamp circuit is first turned on, then the key, K, is pressed, which brings the current of the standard battery, S, into opposition to the current from the main battery, through the galvanometer, G. If the electro-motive force of the main battery is too weak, the needle of the galvanometer will be sent to the right of zero a few degrees by battery S; but such movement is at once overcome by diminishing the resistance in the main circuit through the sliding of the collar on rod No. 1 toward the left, in the direction of key, K. As quickly as the resistance is cut out by this movement, so is the needle of the galvanometer forced back to the left until it reaches the zero point; then the batteries are exactly balanced, and the light obtained is equal to that of a standard candle; at this zero reading we have also a constant number of volts of electro-motive force.

A bunch of twenty lamps accompany the apparatus, and may be seen resting upon the base board near the galvanometer. Although all of the lamps may possess the same electrical resistance, they will not emit an equal amount of light, hence in inserting a new lamp it is necessary to locate the hinged pointed metal foot under the brass rod No. 2 at a different point on the millimeter scale, to correspond with the number marked on the label attached to each lamp.

The mode of testing the candle power of each lamp is to first set the hinged pointed foot arbitrarily at some number on the millimeter scale, then to turn on the switch of battery M, and gradually slide the wheeled collar from the extreme right hand end of rod No. 1 to the left until enough resistance is cut out to make the intensity of the light from the lamp equal the light of a standard candle, and at the same time to see that the reading of the galvanometer is zero.

The average of a large number of photometric readings is taken to determine the uniformity or the intensity of light emitted from the standard candle.

In view of the differences in the lamps, each one is marked with a special number, which is the separate test, as was shown on the millimeter scale, when it was originally tried, and is to be used when the lamp is put into the main circuit of battery, M, in the manner previously described.

The electrical standard of light thus obtained is far more constant and reliable than that obtained from the standard candle in that all variation of the flame or the uncertainties of the wick are avoided. The galvanometer employed is of the ordinary pattern, having an estimated resistance of about 500 ohms.

As soon as any blackening occurs on the interior of the globe, or even before it, which is due to the gradual destruction of the carbon film from long use, the lamp is removed and a new lamp substituted.

The lamp when employed in making the photographic tests is used but a few seconds at a time, and it is estimated one lamp will, on this account, be good for several thousand tests before the variation of the light will amount to more than one per cent.

Much credit is due to Mr. Edison and his assistant in working out the practical details of the apparatus, and the simplicity and delicacy by which the resistance is employed to control the current of the variable battery is especially commendable.

So delicate is the balance that the resistance of a quarter of an inch of the resistance wire can be read on the galvanometer.

The application of the light in testing the sensitiveness of photographic dry plates may be described as follows: A sensitive dry plate is placed in contact with a Woodbury carbon screen (see Fig. 3), such as is used in a Warnerke sensitometer, in a plate holder, and the latter is set into a groove at one end of the testing box, the slide protecting the plate from all light, then being withdrawn, as shown in Fig. 1. The electric lamp is then placed so as to be opposite the center of the screen and twenty-four inches therefrom. The switch putting the battery M in circuit is now turned on, and the light emanating from the lamp is allowed to act upon the screen for twenty seconds; it is instantly stopped by turning off the switch.

The sensitive plate is next removed from the plate holder and placed in a developing solution of a given strength for five minutes, and it is then taken out, washed, and immersed in a fixing bath of hyposulphite of soda until the bromide of silver film unacted upon by the light is dissolved out. It is again washed, and when dry is laid film side down upon a piece of white paper. The highest number on the finished negative which can be seen represents the sensitiveness of the plate, and by means of comparative tests the relative sensitiveness of different plates is thus easily determined.

It should be mentioned that the Woodbury screen (Fig. 3) is a plate of glass coated with a film of carbon tissue divided into squares, and is made by exposing the sensitized tissue behind another negative screen having similar squares, for a certain number of minutes to the light of the sun, and afterward developed, by dissolving out, with hot water, the parts of the film unacted upon by light. Each square is shaded to be a

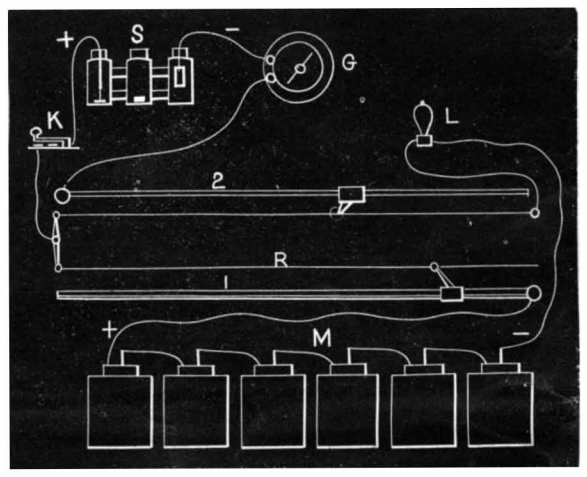

Fig. 2.—DIAGRAM OF CIRCUITS.

trifle more dense than its neighbor, and they are distinguished by numbers.

No. 1, it will be noticed, is quite transparent, while No. 25 is nearly opaque. The row of figures at the bottom is intended to show in a more compact way the difference in the shading.

A sensitive plate showing a reading of 25 will be regarded as having an extreme degree of sensitiveness; and other things being equal, such as freedom from fog in the film, will be excellently adapted for taking instantaneous pictures. One showing 14 would be considered very slow, but excellent for copying or for ordinary landscape work. Nearly two hundred tests have been very successfully made with the lamp, and it forms a valuable addition to the photographic laboratory. In addition to its application to photography, the light may be used for many other purposes, such as comparative photometric tests with other kinds of illuminants. It forms a ready and convenient standard for use in the laboratory, or even for use in gas works, and is an improvement which has long been sought for.

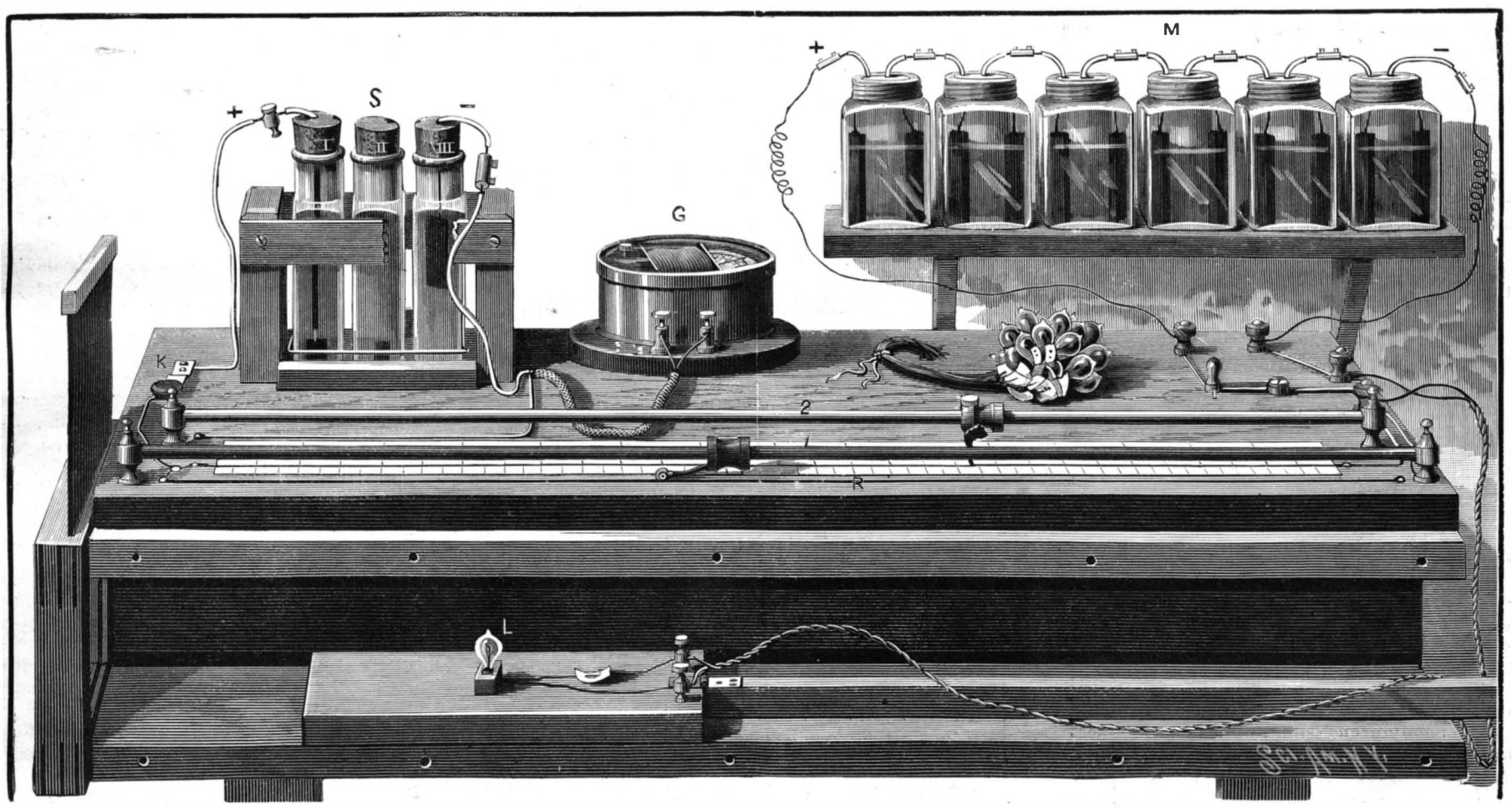

Fig. 1.—ELECTRICAL APPARATUS FOR MAKING PHOTO-SENSITOMETRIC TESTS.

Mr. Edison and the Society of Amateur Photographers are to be congratulated on their success in at last having found a practical method for the more exact measurement of light. It is a matter of scientific interest to the community at large, and is well worthy of the attention of all who are in search of a standard light.

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MONUMENTAL NESTS.

BY C. F. HOLDER.

Among the many fictions of zoology, that relating to the method of nesting of the flamingo seems to have been one of the most fortunate in surviving, as it is only within a year that the question has been fairly settled. In almost every popular book of the day, where the nest and bird are figured, the latter is shown sitting astride of the nest. In one of the late taxidermists' exhibitions, a group of these birds was displayed, superbly mounted, and correct in every detail except this—that the legs were astride the nest.

Sir John Richardson writes in his Museum of Natural History: "The nest of this bird is very curious, being a small hill of mud with a cavity in its summit. In this the female lays two or three eggs, which she hatches by sitting astride upon the hillock." Nuttall evidently took the same view of it, for he says: "They breed in societies in inundated marshes; during the progress of incubation raising the nest to the height of the body by collecting mud into a hillock with their feet, where they brood and hatch, often standing in the water."

It finally occurred to some one to examine a flamingo, and measure the top of the nest, when it became evident that the diameter of the nest was greater than the distance between the legs of the bird, and that such a position was impossible.

Mr. Maynard has settled the matter by visiting a rookery in the Bahamas, where he observed hundreds of these birds upon the nest; and in every case the legs were drawn up, the flamingoes nesting like other birds, as the stork, for example.

The nests in this rookery were from one to four feet in height, formed of mud, and standing partly in the water. It is interesting to note in this connection that, although the flamingo does not dangle its legs on either side of the nest, there is an American bird that does, and I am indebted to Mr. Richard Holder, of Freeport, Ill., for a sketch of the nest of a sandhill crane (*Grus canadensis*) that formed one of a number observed on his estate near Bloomington, Ill. For several years they were not disturbed, and he had many opportunities for studying their curious ways. The nests were formed in a marsh, some of them being built in the water, of mud and rushes in a pillar shape to a height of about two feet, and in some cases more, having a regular and somewhat ornamental appearance. They were surrounded by rushes, and so protected from view.

In nesting, Mr. Holder informed me that they sat upon the nest exactly as the flamingo was supposed to do, with a leg hanging down on either side, resting on the ground or in the water, so that they could easily rise and step away. For a number of successive years they were observed in the same locality always resting in this way. At this time they were extremely pugnacious, attacking all comers with great fury, striking with their powerful wings and beaks.

The courtship of the brown crane, as it is also called, is an amusing performance, and from a shelter near this rookery the actions of the birds were often watched. The love-making appeared to consist of feats of physical prowess enacted by the males for the benefit and amusement of the gentler sex. The performance includes the most absurd and grotesque movements. A bird would suddenly raise its wings and run about, capering this way and that, as if taking steps to the measure of some accompanying music. Now it would leap in the air, hopping entirely over the back of a comrade, as shown in the accompanying illustration, then strutting off with an inimitable dandified air.

HABITS OF THE CRANE.

Nearly all the cranes are noted for their curious and erratic actions at this period, but none equal those of this great bird. In appearance they are exceedingly majestic, standing nearly or quite four feet high, and presenting a curious spectacle when on the wing.

These birds range now from Florida to the Pacific, wintering as far south as Florida. They appear in the Washington Territory in April, arriving in large flocks, and building on the most exposed parts of the open plain—a plan that enables them to discern their enemies a long distance off. In the Colorado River valley they are very common in the summer time; flocks composed of many thousands often appearing in quick succession, the roar of their wings and the loud cry of the leaders being audible a great distance. The nests of the flamingo and sandhill crane are not unique, as quite a number of birds build in a similar way, the nest being elevated for various purposes. That of the whooping crane is at least two feet high, and, according to some authorities, the elevation is to allow the legs of the bird to rest on either side, as in the case of its ally, the sandhill crane. While the latter bird is confined more to the interior portions of the continent, the whooping crane is found in various localities on the coast, but in yearly decreasing numbers. In former years they were seen in vast quantities. Of their noise, Captain Amidas said that when he landed on Wokokon Island, on the North Carolina coast, it sounded as if an army of men had shouted in concert.

Concerning their migrations in the early times, Nuttall writes: "In the month of December, 1811, while leisurely descending on the bosom of the Mississippi, in one of the trading boats of that period, I had an opportunity of witnessing one of these vast migrations of the whooping cranes, assembled by many thousands from all the marshes and unpassable swamps of the North and West. The whole continent seemed as if giving up its quota of the species to swell the mighty host. Their flight took place in the night, down the great aerial valley of the river, whose southern course conducted them every instant toward warmer and more hospitable climes. The clangor of these numerous legions, passing along high in the air, seemed almost deafening; the confused cry of the vast army continued with the lengthening procession; and as the vocal cry continued nearly throughout the whole night, without intermission, some idea may be formed of the immensity of the numbers now assembled on their annual journey to the regions of the South."

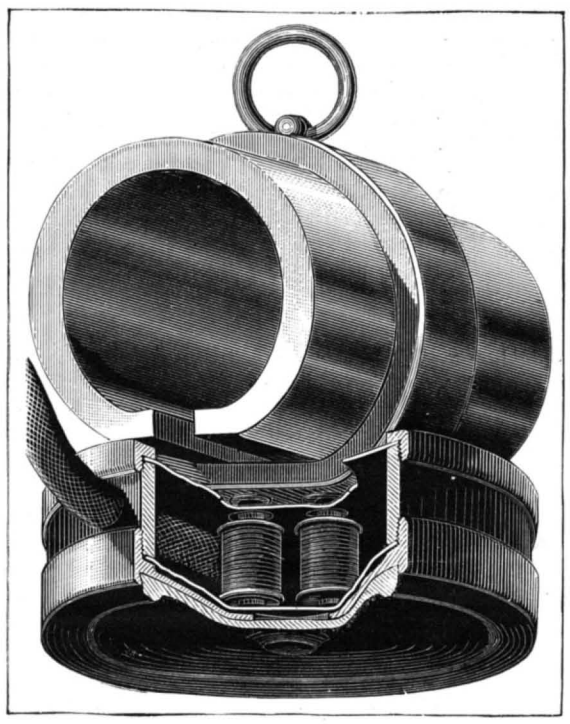
One of the albatrosses erects a nest two feet in height, rounding it off so that the top is much the largest, allowing a full rim to hang down on all sides, so that from a distance they look like inverted hats. Professor Mosely found a practical use for them on the Challenger voyage, utilizing them as seats when he became fatigued tramping over the desert spots in which they were found.

DR. OCHOROWICZ'S LOUD-SPEAKING TELEPHONE.

An endeavor has, for a long time, been made to devise a telephone system that should transmit speech to a distance with sufficient intensity to be heard within a certain radius around the apparatus, and without the necessity of applying the receiver to the ear.

The problem has already been partially solved by Mr. Gower, and by Mr. Edison in his electro-motograph. Dr. J. Ochorowicz has recently presented a still completer and more perfect solution to the International Society of Electricians and the French Society of Physics.

In the construction of his apparatus the inventor had especially in view the application of it to the auditorium of theaters, for which, in fact, it appears to be well adapted. The system, as a whole, includes a transmitter of variable resistance, the special arrangement of which Dr. Ochorowicz keeps secret; and of a magnetic telephone receiver, whose principal features are shown in the annexed cut. This receiver, which is identical with Bell's, since it contains the three essential parts of that instrument (magnet, bobbin, and vibrating disk), differs from it, however, by important modifications of form, to which it owes its remarkable power.



OCHOROWICZ'S LOUD-SPEAKING TELEPHONE RECEIVER.

The magnet consists of a hollow steel cylinder, containing a logitudinal slit about a fifth of an inch in width. To the center of this are fixed two small soft iron cores, upon which are placed two bobbins that are traversed by the undulatory current modulated by the transmitter. These two bobbins are inclosed in a sort of elastic metallic box, formed of two thin sheet iron disks held parallel by their external edges upon a cylinder. The lower plate, which is firmly affixed to the magnet, contains two apertures, which allow the iron covers to pass freely.

The magnetization of these cores keeps the box thus formed in a state of tension, and the two ends of sheet iron slightly depressed and attracted toward each other. The effect of the variations in the undulatory current which is traversing the bobbins is to increase or diminish the magnetization of the cores, or, we might say, to cause the *flow of force* to vary. The box becomes compressed or dilated under the action of such variations, and vibrates *in its entirety*.

Thus is explained the power of a receiver which, connected with Dr. Ochorowicz's special transmitter, has permitted speech, song, and music to be heard throughout the entire hall of the Geographical Society—a room capable of holding as many as five hundred persons. The telephone receiver is capable of operating as a transmitter. Speech is, in this case, transmitted with less power, but it has still enough intensity to be easily and very distinctly heard at a yard or two from the receiving apparatus.

In the microphone transmitter employed by Dr. Ochorowicz, heat appears to play a certain role, if we are to judge by the fact that all the experiments repeated before the Society of Electricians, February 4, succeeded except the last. Dr. Ochorowicz attributes this result to the fact that it is necessary for the microphone to be warm in order to be regulated. As soon as it ceases to be so, the regulation is destroyed, and is not effected again until a new heating occurs. Since, in the experiments mentioned, Leclanche piles were used, these became polarized after a certain time, and allowed the receiver to get cool. Such an inconvenience is remedied by the use of Daniell and Lalande and Chaperon piles, or of accumulators. It must be also noted that, in Dr. Ochorowicz's system, transmitting is done *directly*, without the intermedium of an induction coil acting as a transformer.—*La Nature.*

DROWNING NOT PAINFUL.—A good deal has been written as to what the sensations of people are supposed to be who are drowned. The *Nautical Magazine* for March relates how a little girl who was thrown into the Thames, at Kew, by its nurse, explained the matter to a jury in her own simple way: "I sank till I felt my feet touch the bottom, and then I fell asleep till I found myself wrapped up in a blanket in the boat house." She added: "There was no pain beyond the first shock of the water." It may thus be gathered that death from drowning is by no means a painful one.

Photo Notes.

The *Mittheilungen* says: Herr Himly (of the firm of Siemens and Halske) was lately commissioned to photograph a document with an aniline blue ink. Of course, the usual process was unsuitable, as the writing would have come out white. Herr Himly then tried a plate stained with azaline, and the reproduction succeeded to perfection. The editors were also successful in photographing, in the same way, dra wings upon yellow paper.

Herr Himly also communicates to the same paper a slight novelty in the treatment of lichtpaus pictures upon ferro-prussiate paper. It oftens happens, particularly in summer, that pictures on ferro-prussiate paper are overprinted, and their blue color assumes a dirty, dark, greenish tint. Such prints may easily be saved. Herr Himly prepared a very weak solution of caustic potash, and places the overprinted picture in it until the lines become clear and the whole thing appears gray, the greater part of the coloring matter having been converted into iron oxide. He then prepares a weak solution of hydrochloric acid, and immerses the print, when it once more comes out a fresh blue color. The picture is then washed and dried in the usual way.

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PRUNING ORNAMENTAL TREES.*

Many will remember when it was common, in planting street trees, to trim them to a bare pole and cut off the top, like the left hand tree in Fig. 1. This treatment, however, nearly always resulted in success in securing the growth of the tree, for if the top had been allowed to remain, it would have been too heavy for the mutilated roots. The wind would have blown it about, and the supply of moisture from the soil

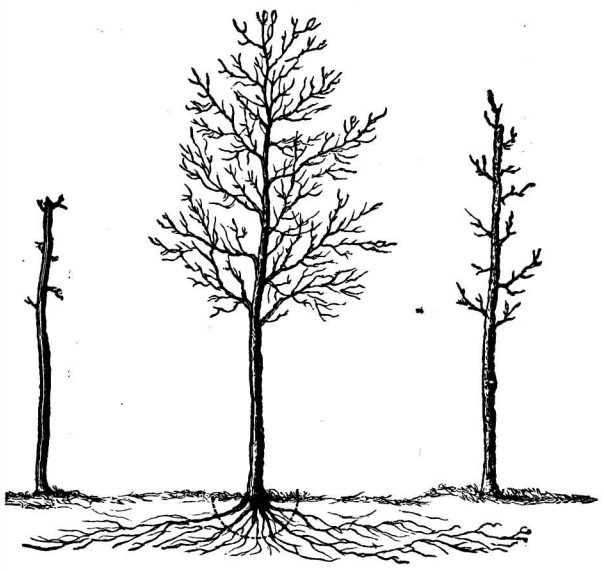

Fig. 1.

would have been insufficient for the large mass of leaves above. This result will be obvious on examining the central figure, which represents the tree before removal, with all its top, showing partly the length of the roots in the soil, which, however, are twice as long as represented, as tree roots in general are found to be quite equal to the entire height of the tree, and often much more. The circular line at the base shows the usual length of the roots when cut in taking it up, and it is obvious at once from the picture that these short roots could not hold and feed the entire mass of branches and leaves.

The bare pole, however, is long in recovering from this severe lopping and in forming a new head; but if the pruning is performed so as to leave three-fourths of their length, and with most of the small shoots cut away, the roots will then be able to sustain them, and a new head will be readily formed from these shortened branches in much less time.

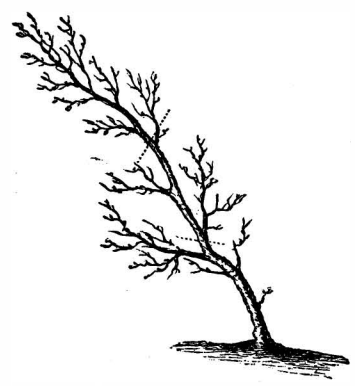

Fig. 2.

It is important that the shortening should be properly done, so that the new head may have a good, symmetrical form, and no dead stubs remain. Fig. 2 represents a single side branch, and by the small dotted lines the place is indicated where it may be cut off. By selecting the place of a fork, and cutting away the longer of the two at this fork, no stump will be left. If this is done at the outer line, the branch will be reduced nearly one-half; and if at the inner line, two-thirds or three-fourths will be cut away, and an even, smooth head thus obtained.

If a proper framework is provided for the head when the tree is young, but little heavy pruning will be required afterward; but neglected trees often require some lopping of large branches in after years. Sometimes the saw is set in at the top of the branch and near the body of the tree, and when cut nearly through, the weight of the limb bends it down and it splits off, leaving a bad wound, as shown in the figure (Fig. 3). To avoid this disaster, set the saw on the lower side and cut in a short distance (as in Fig. 4), and then cut above a little farther out than the lower cut, and the limb is severed without injury. The whole may then be made smooth by sawing off the stump nearer to the body of the tree, or this second sawing may be avoided by bringing the two first cuts nearly in the same line, the upper one being slightly outside the lower one.

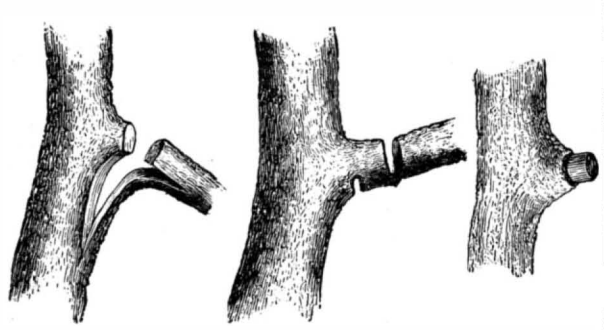

Fig. 3. Fig. 4. Fig. 5.

A very common and bungling mode of pruning off side limbs is to leave stumps two or three inches long. The new wood attempts to heal the wounds in the process of growth, but many years are required to cover them. The mound which the growing wood forms at their base, shown in Fig. 5, renders a larger wound necessary if the whole is pruned away to form a smooth tree.

In planting and raising trees on ornamental grounds, they should not be pruned away from their natural shape; but while deformity is always to be avoided, the characteristic beauty of every kind should be retained. The attempt should never be made, for example, to train the American elm into the form of a Lombardy poplar, nor the oak into a weeping willow. The oak has its own peculiar characteristics, as shown in Fig. 6; the rounded head and drooping branches of the elm give it a grace and beauty which should be strongly retained. When these and other ornamental trees are young, their forms may be directed in pruning by adopting the principle represented in Fig. 2, at the same time avoiding stiffness and formality. The Norway spruce, and some other evergreens, exhibit the finest shape when the branches are allowed a natural sweep by resting on the ground, as shown in Fig. 7. By selecting those specimens in the nursery row which show this luxuriant and drooping habit, very fine forms may be secured. Persons who have no appreciation of natural beauty are occasionally met with who trim up the stems several feet from the ground, Fig. 8, reminding the spectator of boys on stilts.

Fig. 6.

The most unnatural and deformed mode of training ornamental trees, and mostly confined to evergreens, is seen in what is termed topiary work. In Fig. 9, the central object represents an evergreen trained into something most nearly resembling a haystack, a form often met with in dooryards and small places. The two other trees are given forms as remote from their natural grace as can well be imagined. The labor required to keep such trees constantly in these unmeaning shapes would be sufficient to take care of ten times as many trained in their own characteristic forms.

Fig. 7.

Less objectionable, but still giving a somewhat stiff and unnatural outline, are the gateways seen on highly finished grounds, Fig. 10. Four trees are planted, or two on each side of the passage, the two nearest the gate being bent and brought together over the center, and the two outer ones allowed to grow erect. With much labor in training and shearing they are given the form represented. More pleasing to the admirer of natural beauty is the gateway shown in Fig. 11, where the trees have their natural growth, and are cut away only enough for a passage next to the gate. A passage through a hedge or screen is easily made in this way, and if the hedge is partly obscured by irregular planting near its sides, the whole view may be entirely in keeping with natural planting of the grounds.

Fig. 8.

The remark is sometimes made with much confidence, in referring to the various forms of training ornamental trees, whether stiff or graceful, natural or distorted, that there is "no disputing tastes," and that one person's preference is as good as another's. This would not be admitted as universally true by any one, as applied to the difference between a beautiful Grecian statue and one of the coarse images of pottery kept as idols by savage nations, and no American would admit that the practice of the Chinese women in distorting their feet into the shape of apple dumplings is preferable to the natural form. For similar reasons, the natural grace of ornamental trees will be preferred by a cultivated taste to stiff and grotesque shapes which entirely obscure the natural beauty. The frequency with which minor deviations are seen from true taste renders the exhibition of just principles a matter which should not be overlooked, but which should be presented frequently to the public.

* To that excellent agricultural newspaper, *The Cultivator and Country Gentleman*, we are indebted for the illustrations and article on "Pruning Ornamental Trees."—ED.

The African Inland Sea.

A party of French engineers and hydrographers has left for Tunis, charged with making the necessary studies on the spot for the construction of the harbor in the Bay of Gabes, at the mouth of the Oued Mellah,

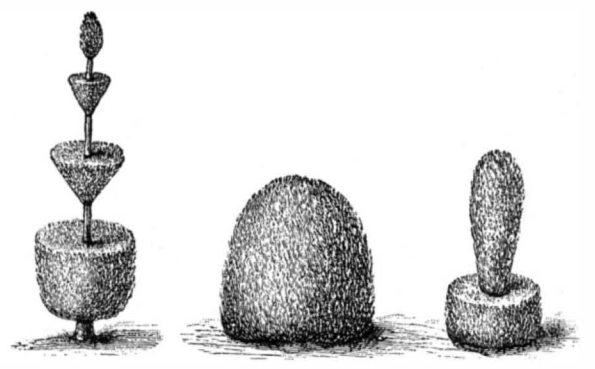

Fig. 9.

in connection with the canal which is to establish navigable communication between the Mediterranean and the Chotts. It will be remembered that, in the early spring of 1883, M. De Lesseps made a trip to those great marsh lakes in Southern Tunis which it is the intention to convert into a vast inland sea, with a view of testing the results of the late Colonel Roudaire's survey, and that he came back convinced that the scheme was practicable. The expedition which has now started will also make investigations as to the feasibility of sinking artesian wells along the route, and the survey for a railway which it might hereafter be thought necessary to construct.

The head of the expedition is Commandant Landas, Professor of Topography at the School of Saint Cyr. He is accompanied by M. Baronnet, who assisted Colonel Roudaire in making the preliminary surveys, and several other engineers. It may be advisable to recall to mind the chief features of the report on the undertaking which M. De Lesseps published after his return from Tunis in 1883. It states that the estuary of the Oued Mellah, which is to be the beginning of the canal leading to the Chotts to be inundated, offers a part, covered at high water, of sufficient breadth, which might easily be excavated, and would form a part sheltered by nature from all the winds from northeast to south passing by the west. The winds from northeast to south passing by the east would not be dangerous to the breakwaters. The roads in front of the entrance are, moreover, in exactly the same situation as those of Gabes. The navigation in the canal, according to the report, would offer no difficulty, as the canal would form almost a straight line. The calcareous rocks found by Colonel Roudaire's soundings in 1879 at the base of the Gabes bar, but of comparatively unimportant extent, are an advantage rather than an inconvenience at the mouth of the canal. They will furnish the requisite material for the construction of the pier and port buildings. M. De Lesseps thinks that, considering the nature of the soil traversed, it will be sufficient to cut, in the alluvial part, a canal, on the average 80 to 100 feet wide, which will be further widened by the action of the current. This cutting could be executed in the maximum period of five years, at an estimated cost of £6,000,000. The proposed inland sea would be fifteen times as large as the Lake of Geneva. It has an elevation much lower than the level of the Mediterranean, the depression being in some places as low as 165 feet below that level.—*Iron.*

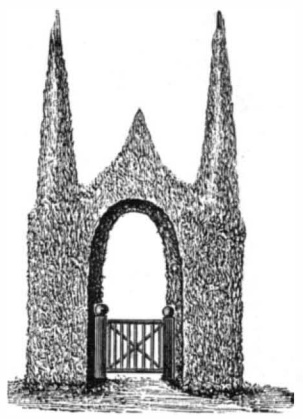

Fig. 10.

Fig. 11.

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ENGINEERING INVENTIONS.

A device for feeding air to furnaces has been patented by Mr. William Thomas, of Pittston, Pa. This invention covers a special construction and arrangement of parts for a steam blower or nozzle, more especially for use in furnaces in which culm is burned, in burning which the ashpit is usually closed and air forced through a tube.

A boiler ash pan has been patented by Messrs. James C. Anderson and Frank H. Latimer, of Winnipeg, Manitoba, Canada. This invention relates to ashpans of locomotive and other boilers, and has for its object the insuring of an even draught of air and its distribution where most effective, air chambers being employed, and with them slots that can be closed, to form a tight bottom to the pans.

AGRICULTURAL INVENTIONS.

A combined cotton sweep, chopper, etc., has been patented by Mr. Thomas J. Fowler, of Birmingham, Ala. This invention covers a special construction, intended to be simple and inexpensive, and readily adjusted and controlled, for a machine to sweep or bar off the plants, chop them to a stand, and dirt or hill them at one passage along the row.

A hay stacker has been patented by Mr. Philo F. Terry, of Green City, Mo. This invention covers certain mechanism whereby the loaded carrier is drawn up the inclined track and the load is automatically discharged on the stack, the apparatus adjusting itself for the descent of the carrier for the next load.

A corn planter has been patented by Mr. Ferdinand Clemens, of What Cheer, Iowa. The seed dropping slides of the seed boxes are attached to a frame hinged to the axle, connected with the axle by a rock shaft with arms, a sliding bar and its holding spring, and a cam wheel, so the seed dropping slides are operated by the revolution of the axle and its wheels.

MISCELLANEOUS INVENTIONS.

A harness pad has been patented by Mr. Herman A. Fonteine, of Auburn, N. Y. It is formed with transverse slots for admitting a free circulation of air to the skin of the horse covered by the pad, to prevent heating and chafing.

A stocking or garment supporter has been patented by Mr. Sherwood B. Ferris, of Lakewood, N. J. This invention provides a supporter consisting of a cord with an adjustable loop at its upper end, a slide at its lower end, and a button attached to the slide by a flexible connection.

A collar button has been patented by Mr. Henry J. Geer, of Attleborough, Mass. This invention consists in the combination, with a U-shaped plate, of a spring catch, a hinged plate, and a headed stud, designed to work so the button cannot drop out of a large button hole, and cannot work loose.

A power jack has been patented by Mr. John W. Massey, of Shuqualak, Miss. This invention relates to power jacks for leveling buildings, laying flooring, rolling logs, etc., and is an improvement on a former patented invention of the same inventor in this particular line.

A wedge has been patented by Mr. Charles R. Countryman, of Sherman, Wyoming Ter. This invention consists in details of the firing devices by which the charge in the wedge is so exploded that the force is expended in splitting the log without damaging the wedge, which may be used repeatedly.

A bicycle has been patented by Mr. Harry H. Jones, of Lancaster, N. H. This invention combines with a foot lever and clutch a band connected with the foot lever, with other novel features to form a bicycle in which the driving wheel is not operated directly from the foot levers, but by intermediate clutches and straps or bands.

A sash fastener has been patented by Mr. Benjamin S. Curry, of Manatee, Fla. Combined with the casing is a pivoted lever, a pin projecting therefrom, and a spring strip with an aperture, and having its upper end bent outward and through a slot in the casing, making an improved device for holding a sash at any desired elevation.

A saw handle has been patented by Mr. Frank A. Buell, of Brooklyn, N. Y. It is a wooden saw handle with a metal bottom bridge, having in its upper surface a dovetailed groove for receiving a dovetailed ridge on the bottom of the wooden part of the handle, making a saw handle which is simple in construction, strong, and durable.

A blasting powder has been patented by Mr. Adrien Gacon, of Paris, France. This invention provides a new explosive compound, intended to have the force of dynamite, but with none of its defects or dangerous properties, the compound consisting of a mixture of nitrate of potash or nitrate of soda with sulphur, ashes, and tannin.

A saw arbor has been patented by Mr. Hyman D. Wolcott, of Wright's, Pa. It has a recessed collar and screw-threaded spindle extending therefrom, and is so made as to accurately center the saw and clamp it in a manner to prevent springing or dishing of the plate, the arbor being adapted for use in jointing machines, in which the saw must be held accurately.

An ice pick has been patented by Mr. Ethan Rogers, of Cohoes, N. Y. The blade has serrated or cutting points at one end, with a weighted head at the opposite end, and an angularly arranged intermediate shank for the handle, so that quick and effective work can be done by a light pick, and the cut ice afterward be readily broken by the tool.

A wood moulding machine has been patented by Messrs. Henry Baxter and August F. Anton, of Memphis, Tenn. This invention consists of contrivances of edge trimmers, moulding bits, and guides in a wood-moulding machine, so two mouldings can be dressed out of one strip at once, and so two strips can be dressed and four mouldings made at the same time.

A fan attachment has been patented by Mr. Albert Nawadny, of New Orleans, La. It is so made as to be readily applied to and detached from sewing machines, a bent rod carrying a fan holder, a spiral spring having hooked ends, and there being a connecting wire by which the fan can be operated from the treadle.

A ticket clip has been patented by Mr. William Souter, of Leeds, Mass. It is an approximately U-shaped piece of spring metal having curved arms, with their convexities presented toward each other to form clamping jaws, one of the arms having a spring tongue or clasp, forming an improved device for holding tickets on garments.

An automatic button fastening machine has been patented by Mr. Albert Hall, of Cypress Hills, N. Y. This invention covers an improvement on a former patented invention of the same inventor, and consists mainly in combining with the fastening device means for automatically feeding the buttons and button fastenings to the hammer.

A water carrier has been patented by Mr. James F. Fine, of Lake, Washington Ter. This invention covers a special construction and combination of parts for a self-acting traveler or carrier adapted to run upon a wire or other tram, whereby people living upon mountains may easily obtain water from the valley below with buckets.

An oiler has been patented by Messrs. John J. Leavitt and John Q. Leavitt, of Salt Lake City, Utah Ter. It has a valve seated in its spout or nozzle, of special construction and operated in a novel way, so that the nozzle may be held downward without waste of oil, and only as much oil as needed for lubrication will be allowed to flow out at the desired spot.

A photographic camera has been patented by Mr. Walter Clark, of New York city. This invention covers a rotating lens holder combined with a camera box of special construction, with separate apertures for exposure and focusing, and fixed object glasses separate from the plate holders, whereby the removal and replacing of the plate holder is not necessary in order to obtain a focus.

An oil cup has been patented by Mr. Ezra Best, of Quincy, Ill. This invention relates to oil cups used for supplying oil to bearings of machinery within steam chambers, and provides means for utilizing condensed steam to cause the oil to flow into the delivery pipe, and to control the amount of steam supply and oil, while enabling the operator to see exactly at what rate the drops of oil are falling into the cylinder.

An agraffe for pianos has been patented by Mr. Augustus Baus, of New York city. It has two prongs, each with inclined aperture, the central axes of the apertures being on the same line, so that under no circumstances can the strings slip, and the tuning pins are relieved of a part of the strain they are subjected to in pianos of ordinary construction, and the instrument will not need such frequent tuning.

A paper hanging implement has been patented by Mr. Oscar L. Case, of Windham, N. Y. The implement first clamps by a jaw-like action one end of a strip of paper, next adjusts the strip to its place opposite to but not against the wall, then holds it at the end to its place on the wall, and finally completes the laying and securing of the strip throughout its entire length on the wall.

A hay rack has been patented by Mr. Jerome Stormer, of Moline, Ohio. This invention relates to racks which may be fastened on ordinary farm wagons to better adapt them for carrying hay, and covers a special construction by which the rack is prevented from moving backand forth on top of the wagon, and the hay is kept from clogging the wheels, the rack being readily taken apart for shipment.

A bone black oven has been patented by Mr. George Murdoch, of Brooklyn, N. Y. Combined with the furnace and ovens proper is a narrow vertical flue extending between the ovens, and small lateral passages leading upward from ovens to flues, the ovens being made with a contracted grate bottom covered with a slide, with other novel features, for making or revivifying bone black.

A time lock has been patented by Mr. Moses C. Hawkins, of Edinborough, Pa. This invention covers an auxiliary train and bolt releasing device operated by the lock spindle, and arranged to open the lock in case of accident to the ordinary time lock, the device being more particularly designed for use in connection with the time lock heretofore patented by the same inventor.

A propelling device for boats has been patented by Mr. Charles F. Smith, of New York city. Combined with a tube having a sliding sleeve on one end are wings or blades hinged on the sleeve, with various other novel features, constituting a propelling device which can be held in rowlocks or other guides on the bow or stern of a vessel, and operated by hand, foot power, or machinery.

A bottle stopper has been patented by Mr. Charles L. Morehouse, of Brooklyn, N. Y. A metal plate is made with two downwardly projecting arms, the lower ends of which are pivoted eccentrically to links that are in turn pivoted to a spring collar or band clamped on the neck of a bottle, with other novel features, constituting a bottle stopper that is simple and effective.

A unicycle skate has been patented by Mr. James B. Elliott, of London, England. A wheel with ball bearings is loosely mounted on a short shaft, on which a bar is held by a winged nut, the end of the shaft passing through a vertical slot in the bar; the front part of the skate is held by clamps, while the heel of the boot is pressed into a heel socket and a bolt snaps into an aperture in the back of the heel.

A skillet cap or cover has been patented by Mr. Frank R. Wells, of Lagonda, Ohio. It consists of a hollow body portion open at both ends, with a raised flange around the lower end of the body portion, the handle being pivoted at one end and so bent that its other end bears against the side of the skillet cap, making a pan cover which is very efficient and easily cleaned.

A door check has been patented by Mr. Charles E. Hewitt, of Brandon, Vt. It is a door stop, with a base and means of attaching it to the floor, a head piece pivoted to the base and adapted to hold the swinging edge of the door, the head carrying a spring and tongue stop, with other special features, forming an inexpensive device for holding doors open to any desired extent.

A feathering paddle wheel has been patented by Mr. William Emmett, of Logansport, Ind. Longitudinally slotted shafts are journaled in end wheels or circular frames, and in each of the shafts a paddle or blade is held to slide transversely to the length of the shaft, the blades having stops and shoulders for automatically adjusting themselves in a horizontal position when leaving the water.

An adjustment for solar cameras has been patented by Mr. William C. Strong, of Kent's Hill, Me. This invention covers a special mechanism to afford facilities for the ready adjustment of the mirror, to cut off communication with the outside air, for adjusting the projecting lens by a pivoted lens bar, to render the slide holder readily removable, with various other novel features.

A valve cock has been patented by Mr. Henry J. H. Brooks, of Bloomfield, N. J. It is so made that if the thread in the neck wears out it can be easily replaced by another by removing a block tin core, and the edges of the valve and seat are slightly curved to cause them to fit and form a close joint, the globe being dispensed with, and the flow of steam, water, etc., not being interrupted by projections.

A feed regulator for roller mills has been patented by Mr. Forrester M. Tatlow, of Hannibal, Mo. This invention covers certain combinations and details of construction making a feeding device adapted for use on roller mills, middlings purifiers, and wherever a steady, even stream of feed is required, and is intended to operate upon the coarsest bran or the finest middlings, or upon any kind of grain.

A tenoning machine has been patented by Mr. James R. Brumby, of Marietta, Ga. This invention covers a machine which is automatic in its action, and in which both ends of the sticks are tenoned at the same time, the tenons, owing to the exact alignment of the cutters, being always exactly in line with each other, so that no further operation is necessary to fit the sticks for use.

A transportation barrel has been patented by Mr. Reuben H. Kachline, of Martin's Creek, Pa. It is made with staves connected at their side edges by tongues and grooves, and so held together by adjustable hoops that the body of the barrel can be expanded and contracted as required, so that fruit or other substances can be pressed in the barrel, or the barrel can be conveniently ventilated should that be desired.

A candle machine has been patented by Mr. Gregory Roths, of Cincinnati, O. This invention combines wick spools and tightening rollers with a candle machine, so the wick can be drawn tight previous to moulding, and also drawn through the moulded candle to save cutting off, thus effecting a saving of wick and keeping the stearine or other material free from the impurities caused by the remelting of the portion of the candle usually cut off with the wick.

A bag, pocket book, or purse frame has been patented by Mr. Louis B. Prahar, of Brooklyn, N. Y. Combined with the front bar of the frame, carrying catches, is a knob attached to the locking bar connected with the rear bar of the frame, an inclined finger connected with the front bar resting against the knob, so the bars of the frame will be forced apart by the movement of the locking bar, thus promoting convenience in opening bags, pocket books, etc.

A wheel for vehicles has been patented by James E. Deweese, of Nevada, Mo. The hub has dovetailed sockets and a removably bolted plate; the spokes are of thin spring metal, with their inner ends enlarged and their outer portions curved and sprung to re-enforce the rim, the free ends of such curved portions lapping the heels of the adjacent curved and sprung portion, making a wheel which is very strong, light, and easily repaired.

A bale ejector for baling presses has been patented by Mr. John L. Duval, of Houston, Tex. In combination with a baling press follower, trucks are provided with ropes or chains, pulleys, pulley segments having arms, and stationary arms for drawing the trucks forward, and ropes or chains, pulleys, and weights for drawing the trucks rearward, with various other novel features, whereby the bale is removed from the press by the movement of the follower.

A fire escape has been patented by Mr. Ephraim Watts, of Middletown, Pa. This invention relates to fire escapes in which a car or receptacle is fitted to move up and down a portable frame or support placed on or against the outside of a building, and covers a peculiar arrangement and combination of parts therefor, so a person may raise or lower himself to any desired position by pulling on a rope attached to the car.

A pulp grinder has been patented by Mr. William H. Howell, of Thorold, Ontario, Canada. This invention covers a special construction and arrangement of parts of a pulp-grinding mill in which the running stone is of conical form, and is surrounded by a fixed stone of corresponding shape, the runner being made with curved furrows and the stationary stone having similar furrows running in opposite directions.

A folding bath tub has been patented by Mr. John A. Throckmorton, of Sidney, Ohio. It consists of a flexible waterproof bag or receptacle with a hem at its upper edge and a rectangular frame with folding legs, adapted to be disposed parallel to the end section of the frame, the frame having side sections each composed of five jointed pieces, making a bath tub which may be easily reduced to the limits of a trunk for ready transportation or compact storing.

An oil press mat has been patented by Messrs. Alfred Jones and Thomas Blake, of St. Louis, Mo. This invention relates to wire mats used in compressors, which are hereby so constructed that the oil is prevented from lodging in the edges of the mat, thus giving a "dry edge" to the substance being pressed, the oil is prevented from accumulating in the meshes of the mat, and the substance is restrained from spreading beyond the surface exposure of the mat.

An adjustable mirror has been patented by Mr. Stearns K. Abbott, of Charlestown, Mass., P. O. Box 100. This invention covers the use of a specially contrived frame for holding the mirror, and in which the mirror can be readily adjusted and held in any desired position, for use for either tall or short people, or for children sitting on the floor, so that mirrors of medium size may be made more useful than large mirrors as ordinarily hung.

A photographic plate or sheet holder has been patented by Mr. Erastus B. Barker, of New York city. This invention consists in a combination, with the septum of the holder, of an open hinged or swinging frame made to clamp the marginal portions of the sensitive sheet on or against the septum, with other novel features, making a device for which the ordinary plate holders used in taking glass negatives are not adapted.

A photographic paper and sensitive emulsion therefor has been patented by Mr. Thomas C. Roche, of Brooklyn, N. Y. The paper has a toothed facing of gelatine and bromide of silver, and the invention also covers a compound for facing photographic paper consisting of gelatine, bromide of silver, and a suitable toothing substance; also a combination, with a photographic emulsion of gelatine and bromide of silver, of a toothing substance, such as the sulphate of baryta.

A churn dasher has been patented by Mr. Redford W. Fisk, of Council Grove, Kansas. This invention covers a novel construction, whereby wings and ribs so act in connection with the bottom of the churn that it can be advantageously operated with a small or large quantity of cream, the rapid motion of the dasher throwing the cream against the sides of the box, and keeping it from one to four inches higher than at the center, while the butter globules float on the top of the cream and collect at the middle.

A combined metallic cap and fastener for bottles forms the subject of two patents issued to Mr. Alfred L. Bernardin, of Evansville, Ind. The cap has a pendent circular flange to embrace or cover the bottle nozzle, or otherwise a collar is adapted to fit under the neck of the bottle, and made integral with vertical strips, the lower part of the fastener being detachably secured to the cap flange by means of clips, and the invention being especially designed to be used with corks that protrude into the neck of the bottle.

A pump has been patented by Mr. Hans Mortensen, of Leadville, Col. It is so constructed as to almost balance itself, requiring only sufficient power to lift the amount of water discharged at each stroke; with two upper cylinders open at the bottom are two lower cylinders open at the top, piston rods passing through the cylinders of each pair, the top and bottom cylinders of each pair being connected with a stand pipe, and the invention covering various other novel features.

A pump guard has been patented by James B. Brown, of Hannibal, Mo. This invention covers a special construction to dispense with the usual foot roller which guides the chain of a chain pump into the lower end of the tube and guards the tube from wear, substituting therefor a device less likely to get out of order by wear and rough usage. A device for replacing pump chains has also been patented by the same inventor, the object of the invention being to regain chains which have been lost, and to restore the same to their proper position in the pump.

A brick machine has been patented by Mr. Andrew J. Miller, of Meadville, Pa. Among the novel features covered by this invention are a sectional arrangement of the head of the plunger to allow it to rest while the filled moulds are pushed from beneath it; a special arrangement of relief gate at the front of the press box to allow obstructions to be removed, and means for operating the gate; also in regard to the die in the press box, and in the mechanism for reciprocating the mould discharger, for regulating its stroke, and for stopping it when meeting obstructions, etc.

An improved system of building jetties forms the subject of two patents issued to Mr. Frank A. Hyatt, of Sabine Pass, Tex. According to this invention the entire jetty, except the sills and mats, is made of metal and stone, the only wood being the sills, which are completely embedded in mud, so no part of the structure can be injured by the teredo, and the metal plates are to be coated with suitable material or paint to prevent their oxidation, the whole making a form of jetty adapted for use in deep water, or where the current is very strong, and great strength in the jetty is required.

A dynamite shell has been patented by Mr. James F. Marvin, of Fort Apache, Arizona Ter. It is intended to overcome the danger from firing dynamite from guns, the projectile consisting of two parts, a head with a cavity for holding the dynamite, and a skirt forming a casing that fits easily on the barrel, so the head covers the muzzle; the design is that when the gun is fired, the air space between the powder in the bore and the base of the projectile will become so charged with expansive gases that the pressure will force the projectile forward without jar, friction, or vibration.

A child's carriage has been patented by Messrs. Eugene A. Gerbracht, of New York, and Ernest W. Gerbracht, of Brooklyn, N. Y. The vehicle is constructed with side bars connected by pivoted diagonal bars and a spring; to the side bars are attached the short axles of the wheels and the side parts of the body, the latter having a flexible connection, and the parts of the vehicle being held in place, when folded, by a fastening, the vehicle being especially adapted for folding together to take through doorways and narrow places. The same inventors have obtained an additional patent on a seat which folds with the carriage, and which, when the carriage is open for use, becomes rigid, and serves also as a lock brace to hold the various parts of the carriage in place.

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Curtis Pressure Regulator and Steam Trap. See p. 222.

For Steam and Power Pumping Machinery of Single and Duplex Pattern, embracing boiler feed, fire and low pressure pumps, independent condensing outfits, vacuum, hydraulic, artesian, and deep well pumps, air compressers, address Geo. F. Blake Mfg. Co., 44 Washington, St., Boston; 97 Liberty St., N. Y. Send for catalogue.

Woodwork'g Mach'y, Rollstone Mach. Co. Adv., p. 222.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Information requests on matters of personal rather than general interest, and requests for **Prompt Answers by Letter,** should be accompanied with remittance of $1 to $5, according to the subject, as we cannot be expected to perform such service without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Minerals sent for examination should be distinctly marked or labeled.

(1) E. P.—There is no easy way of tinning cast iron. All the processes for tinning on other metals work but indifferently upon cast iron.

(2) C. H. D. asks: How much steam pressure can be carried in a chamber made of cast iron 6 feet diameter by 7 feet high, thickness of iron 1 inch, and if such a chamber can be strengthened, by having braces of cast iron put in, to safely carry 30 pounds pressure? A. As the form of the chamber is indefinite, we cannot answer. If it is a cylinder, with the heads thoroughly stayed by bolts from head to head inside, or a hemispherical head with strong flanges on cylinder and head well bolted, it will stand the pressure. You must provide for 60 tons pressure on each head.

(3) F. E. D. asks if a boiler made out of 10 tubes wrought iron, 11½ feet high, 2 inches in diameter, would generate enough steam to run an engine 3½ inch stroke, 1¾ bore. A. The 10 tubes alone would not be more than half enough as a boiler to run your engine. The engine with sufficient steam will run the lathe. You will need 15 feet of fire surface in the boiler. A vertical tubular boiler is the best.

(4) R. H. writes: I have an engine 2x3; what size boat would it run? A. A small Whitehall boat; 4 miles an hour will be good speed.

(5) S. F. McG.—Dry paper is a very good insulator of electricity. If wet, it of course becomes nearly as good a conductor as the fluid with which it is wet. Kept dry it is about as good as gutta percha.

(6) T. O. L. asks: How do the American watches compare with the Swiss watches? A. The American in all the medium and low priced grades take the lead; in the very high-priced hand made watches, the Swiss watches are usually counted the best, though as to which is actually the best there are many doubters.

(7) L. H. C.—It is impossible to charge a Leyden jar directly from a magneto-electric machine. You might do it by employing an induction coil, and charging the Leyden jar from the secondary discharge of the coil.

(8) A Subscriber asks: Is there any liquid or preparation that will take the yellow color out of piano keys? A. Hydrogen peroxide might do it; that is probably the best bleaching agent that we have for any such use, but sunlight is the agent principally used heretofore.

(9) B. B. McC. asks: Is the electricity which produces the electric light a manufactured article, or is it a natural element simply collected and stored, and not manufactured? A. Electricity may be said to be manufactured. It is certainly produced by the expenditure of power in a machine, and the product, whatever it is, is sold like other manufactured things. We do not know that it is a natural element. It is probably a condition or state of natural elements.

(10) T. H. asks if the electric light will fade goods. A. We think not to any appreciable extent.

(11) B. C.—Stourbridge loam is a variety of fire clay mined at Stourbridge, in England. It is doubtful if it can be obtained in this country. For general uses it can readily be substituted by the ordinary fire clay.

(12) Ind.—We think that the direction of the current through a patient's body, when a battery is applied to a person, has very little to do with its effect.

(13) G. T. asks how to fasten the tin foil sections on an electrical machine to the glass disk. A. Varnish both the tinfoil and the glass disk, and when the varnish is nearly dry press the two together. Use shellac varnish.

(14) A. F. S.—The special manipulation to obtain flat surfaces on lenses and small mirrors for telescopes has been published in books and but partially described in journals. In SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 139, 318, you will find the subject illustrated.

(15) W. H. T. asks the best way to repair a split in garden hose. A. Wind the hose with canvas, well coated with gutta percha or rubber cement.

(16) P. L.—The rain liberates the odors of plants by moistening their surface and opening their pores, the evaporation of the moisture carrying the odors with it. We know of no way to collect odors except by distillation from their natural sources.

(17) A. D. E. asks: What is the number of revolutions the dynamo machine described in No. 161 will make, and the number of revolutions the armature should make to give good results? A. About 1,500.

(18) J. L. P. asks: Is ten pounds sufficient power to register ten pounds on a spring balance, when held in each hand? A. A pull of ten pounds on each end of the spring balance between your hands is ten pounds on the balance and ten pounds for each hand.

(19) J. C. asks: How many horse power ought a boiler, properly set, of the following dimensions to develop: 16 feet long, 38 inches diameter, two 10 inch flues, good engine and about 80 pounds pressure? A. Your boiler is nominally 15 horse power. You may obtain from 20 to 25 horse power, indicated, at 80 pounds with a good engine.

(20) J. C. F. asks: What size and pitch of propeller is best suited for a yawl boat 18 feet long, 6 feet wide, and 26 inches deep, driven by a 2 horse power engine running 550 revolutions per minute? Weight of machinery, 700 pounds. How fast could such a boat go? A. A 20 inch wheel with 3½ foot pitch may give you a speed of 8 miles per hour.

(21) J. H. writes: I wish to construct an elevated tank to supply my house with water. I have thought I would build it of cypress; is there any preparation that I can use that is harmless, to prevent the water penetrating the wood, and that is tasteless? A. Do not know of anything that will be an improvement upon the clean cypress. You may oil the wood with boiled linseed oil, or paint it with Prince's metallic paint (oxide of iron) and boiled linseed oil. Let it thoroughly dry before using.

(22) W. W. asks how to make and clarify vinegar from cider in the shortest time. A. The manufacture of vinegar is essentially comprised in the exposure to the air, causing the oxidation of the cider at a temperature of from 75° to 85° Fah. The process of clarifying is given in SCIENTIFIC AMERICAN SUPPLEMENT, No. 392.

(23) J. D.—Wire like the sample is unfit for a field magnet, as its very thick covering separates the different layers, so that much of the effect of the current is lost. It is probable that the trouble with your dynamo is in the adjustment of the commutator. Have you connected the wires of your field magnets, so as to render their poles dissimilar?

(24) B. B. H. writes: 1. I wish to prepare some electropoion fluid for use in carbon batteries. Can I use tin vessels to mix my acids in without injury to the fluid? If not, what kind of vessels should I use? A. The acid will destroy a metal vessel; use porcelain or earthenware. 2. What does electropoion fluid weigh per gallon? A. It depends upon the amount of bichromate of potash and sulphuric acid contained in the solution. 3. How long can this fluid be kept without spoiling? A. Indefinitely.

(25) H. U. writes: I have made a dynamo similar to that in SUPPLEMENT, No. 161, fields wound with No. 16 wire, armature with No. 24; by exciting the fields with a pint bichromate battery, I can bring an eight candle Edison lamp to incandescence. Now what I would like to know is, could I do any better by winding the armature with No. 18, as SUPPLEMENT No. 161 directs? Also, how wide should the slots on the commutator be? A. We do not think you could improve your dynamo by changing the armature, if you do not object to use a battery for charging the field magnet. The slots in the commutator should be about one-sixteenth of an inch wide.

(26) F. O. H.—Some electric bodies can be charged by stroking with a cat's skin or piece of silk, so that in a dry atmosphere they will retain their charge for some time. It has not been determined when the Eads ship railway will be commenced; probably as soon as the capital to build it is assured.

(27) L. R. asks the correct meaning of the tonnage of a vessel. A. The law defines very carefully how the tonnage of different vessels shall be calculated. An approximate rule for finding the gross tonnage is to multiply the length of keel between perpendiculars by the breadth of vessel and depth of hold, all in feet, and dividing the product by 100. It is generally assumed that 40 cubic feet shall constitute a ton, and the tonnage of a vessel is considered to be the multiple of this ton which most closely corresponds with the internal capacity of the vessel.

(28) J. H. R. asks how to keep a leather band from slipping. The band is 2 inches wide, and connects a driving wheel 21 inches in diameter with one of 4 inches, both of iron. A. A little good beeswax, rubbed on the inside while running, is sometimes a help for such difficulty, but a band of proper size to do the work should not slip if correctly put up.

(29) S. S. W.—The dominical letter denotes the Sabbath, or dies Domini, the Lord's day. The first seven letters of the alphabet are used for this purpose, the same letter standing for Sunday during a whole year, and after twenty-eight years the same letters returning in the same order. The golden number is a number showing the year of the lunar or Metonic cycle. It is reckoned from one to nineteen, and is so called from having formerly been written in the calendar in gold. Full information in regard to the methods of determining these letters can be found in the prayer book of the Protestant Episcopal Church.

(30) R. D. D. writes: In order to decide a wager, will ask the following question: If a cat and a half can kill a rat and a half in a minute and a half, how many cats will be required to kill 100 rats in 50 minutes? A prominent sporting paper has answered "Two cats," which we do not accept. A. According to the terms of this question, it requires one cat and a half to kill rats at the rate of one a minute, or three cats will kill two rats in a minute; therefore it would take three cats to kill one hundred rats in fifty minutes.

(31) L. Y. writes: 1. While coal-tarring fishing nets, the coal tar is slightly heated, and the gas that rises burns the faces and hands of those employed in handling the nets. What solution or wash could be used on the hands and face to prevent this burning, or what would be a remedy for it? Could anything be added to coal tar in tarring fishing nets to make them less adhesive while handling? If so, what is it? The same not being injurious to the twine. A. We would recommend you to use the so-called "paraffine varnish" specially prepared for covering nets by the New York Coal Tar Company. It is entirely without the objectionable qualities found by you. 2. What size machinery, viz., boiler, engine, and wheel, would be suitable for a boat 40 feet long, 8 feet beam, 5 feet in the hold, and drawing 4 feet aft? A. 16 horse power engine and boiler, 3 foot wheel. 3. How large a wheel would be suitable for an engine with a cylinder 6½ inches by 8 inches, carrying 75 pounds steam? A. A 26 inch wheel.

(32) R. G. A. asks: Does the bulk (or displacement) of a boat in locking make any difference in the quantity of water drawn from the upper to lower level? Or is the same quantity required without regard to displacement, and what is the difference, if any, in quantity required in locking the same boat up or down? A. It takes the same volume of water to lock a boat either way. The displacement is equalized by the water leaving the lock when the boat enters, and entering the lock when the boat leaves. the lockage water being the area of the lock multiplied by the height. There is an excessive loss, proportioned to the displacement of each boat, when the lockage is all one way.

(33) J. G. T. & S. write: We have a steam boiler in our basement, with the engine and feed pump on the floor above; and wish to arrange some kind of water indicator with float to give us the depth of water in the boiler from the floor above. We have our steam gauge on the floor above at an elevation of eleven feet above boiler. What would be the variation with this distance from the ordinary distance? A. There is no system of water gauge indicator above the boiler that has as yet proved reliable, although there are several patents for such contrivances. A steam gauge may be arranged in connection with a pipe directly from the steam space to the height of the gauge, arranged so that the water of condensation can drip back to the boiler, thus making the pressure the same at the top of the tube as it is in the boiler. Attach the gauge to the top of the tube with a small siphon, the same as if the tube was the boiler. This will give the correct indication of the pressure in the boiler. If your present gauge connection pipe is filled with water, the gauge should be 5 pounds less than the pressure in the boiler.

(34) J. F. A. writes: I have a detached house with brick foundation walls, in soil of a clayey nature. The cellar is well concreted, but I find that after a heavy rain there is water in the cellar. How can this be effectually remedied? A. Possibly your yard is low next to the house and drains into the cellar; this you should be able to see by inspection in stormy weather. Every yard should be graded so that the storm water runs from the house, toward cesspools or a sewer connection. A cemented bottom will not resist the coming in of water when there is any head, as when the soil is saturated for some feet above the cellar bottom.

(35) L. J. S. writes: We have built several ice houses, and in some of them we built the walls with air spaces, and would like to know which is the best—to have the walls closed on top, so there is no circulation whatever in the air space, or is it just as good if the air space is open on the top of the wall? A. If the top of the air space opens inside the ice house, there is no need of closing it. If the open top is exposed to wind, it should be closed, as the wind blowing across it will produce a circulation.

(36) R. S. asks: If a flume 10 feet wide by 3 feet deep has to be replaced by two iron pipes, how large would the pipes have to be to contain as many square feet as the wooden flume? A. The tubes would require to be each 4½ feet diameter to be equal to the flume 3 feet by 10 feet.

(37) S. L. W.—Mercury flasks hold about ⅛ gallon, and weigh about 12 pounds; they are good for one thousand lb. pressure. You could not compress more than 16 gallons of gas into a flask with any economy. This will give you 240 pounds pressure. We think that copper cylinders that are amply strong would be enough lighter and of more capacity for size than the mercury flasks. Any good coppersmith can make these cylinders.

(38) D. H. G. asks how to change back the poles of a 25 light dynamo that changed its poles from an unknown cause. There are other dynamos handy if they would be needed. A. You should reverse the polarity of your field magnets by the temporary application of a current from another dynamo.

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2. Also how to temper steel for permanent magnets, and the best steel to use? A. Steel for permanent magnets should be tempered about like taps and dies, that is, the temper should be drawn to a straw color. Chrome steel is said to be the best for permanent magnets.

(39) F. I. P. writes: I wish to stain or dye vulcanized paper or papier mache, such as billiard balls or car wheels are made of. I have tried aniline dissolved in water, boiling hot; but have not been able to penetrate the surface of the paper, which is very hard. I have also tried lampblack and asphaltum without success. Would like to stain it different colors, but black principally. A. It will be necessary for you to color or dye the fiber before pressing it into shape. For black: Soak the material for 12 hours in an alcoholic solution of aniline hydrochloride, then remove and immerse in a dilute solution of potassium bichromate. Do not leave it in the last solution too long, or else the fiber may become decomposed. For blue: Use the blue aniline for cotton. For red: Use the Turkey red, and apply in the usual manner.

(40) L.—A mixture of oxalic and citric acids is probably the best compound to use for the purpose of removing ink from parchment. Chlorine or the alkalies would be likely to injure animal tissues. The removal of printer's ink from paper is hardly possible. It is accomplished to a limited extent by means of ether or a solution of soap in water; hot benzol, naphtha, and the like are also used.

(41) A. R. asks: Can you give me a receipt to remove freckles from the face without injury to the skin? A. A commonly used preparation for this purpose is:

Sulpho-carbolate of zinc	2 parts.
Distilled glycerin	25 "
Rose water	25 "
Scented alcohol	5 "

To be applied twice daily for from half an hour to an hour, and then washed off with cold water. 2. What will remove warts painlessly? A. Touch the wart with a little nitrate of silver, or with nitric acid, or with aromatic vinegar. The silver salt will produce a black and the nitric acid a yellow stain, either of which will wear off in a short while. The vinegar scarcely discolors the skin. 3. Can a transmitter from a primary current without a secondary coil work with success? A. A transmitter without an induction coil may be used successfully on a short line. 4. Has it ever been tried? A. It is one of the earliest telephonic experiments.

(42) D. G. would like to know how to make a very good-smelling hair oil that will not be injurious to the hair. A. Castor oil ½ pint, 95 per cent alcohol ½ pint, tincture cantharides ½ ounce, oil of bergamot 2 drachms. Color a pale pink with alkanet root. Many of the hair oils consist simply of almond or olive oil scented with a few drops of otto of roses, oil of musk or neroli, etc.

(43) T. D. B. writes: I have made a pocket battery for running small incandescent lamp; it works well using for half an hour, and after that it will only redden the carbon; it consists of two hard rubber boxes each containing a carbon and zinc separated by a piece of hard rubber, and I use the following solution: Saturated solution of bichromate of potash with one-fifth weight sulphuric acid and ½ drachm bisulphate mercury to pound solution. I understand that those in the market can be used off and on throughout an evening. A. Keep your zinc well amalgamated, and add considerably more sulphuric acid. The kind of battery you describe is not very well adapted to continued use.

(44) E. W. R. asks a rule by which the horse power of different sizes of belts on various sizes of pulleys can be ascertained. A. For the width of belt for a given horse power, the formula is $\frac{4500 \times H.P.}{d \times V} = W.$

And for power transmitted by a given belt, $\frac{V \times W}{1{,}000} = H.P.$

V=velocity of belt, d=diameter of pulley, W=width of belt. 4,500 and 1,000 are coefficients.

(45) G. L. writes: Is it more economical to use a 100 horse power engine running at its utmost capacity, or a 150 horse engine, same power needed in each case? To supply steam for such engine, which is the most economical—to use two boilers which have to be filled very hard, or to put in a third boiler, of the same size as the other two, and use all three? A. The moderate use of engines and boilers is considered economical. The saving of fuel where there is ample boiler power is very apparent. The heated gases going up the chimney with heavy firing is a sure indication of waste. We recommend the larger engine and 3 boilers, lightly fired, with moderate pressure.

(46) C. H. B. asks a process that will etch steel, such as cutters perform in transferring pictures and monograms upon razors and knives. A. Cover all the parts not required to be etched with beeswax, or cover the whole with beeswax, and then make your lines through to the steel; then dip in dilute nitric acid.

(47) R. S. asks the process of giving a tempered blue color to the steel plate and malleable iron castings of a roller skate. Is it done by painting, japanning, or heating? A. In order to obtain an even blue, the work must have an even finish, and be made perfectly clean. Arrange a cast iron pot in a fire so as to heat it to the temperature of melted lead, or just below a red heat. Make a flat bottom basket of wire or wire cloth to sit in the iron box, on which place the work to be blued, as many pieces as you may find you can manage, always putting in pieces of about the same thickness and size, so that they will heat evenly. Make a bail to the basket, so that it can be easily handled. When the desired color is obtained, dip quickly in hot water to stop the progress of the bluing, for an instant only, so that enough heat may be retained to dry the articles. A cover to the iron box may sometimes be used to advantage to hasten the heating. Another way, much used, is to varnish the work with ultramarine varnish, which may be obtained from the varnish makers.

(48) J. D. O. writes: 1. I would like to know the manner of applying gas and air in gas engines. I understand that gas and air are introduced into a vacuum and ignited, which causes an explosion, and so gives motion to the engine. A. There are two methods of using gas in gas engines. One is to draw the gas into the cylinder with a suitable proportion of air by the forward stroke of the piston, and then explode it under atmospheric pressure. The other method is to introduce the mixture of gas and air into the cylinder under compression, or to compress it in the cylinder, and explode it while in the compressed state. 2. How is the gas introduced? A. The common method is to allow the power piston to draw the gas and air into the cylinder by its forward motion. 3. How is the air introduced? A. The air is generally introduced by being simply drawn in through an open valve along with the gas. 4. Relative quantities of each? A. One volume of gas to eight or ten of air in non-compression engines, and one of gas to ten to fourteen of air in compression engines. 5. Process of ignition? A. There are several methods of igniting the gas. The most common method is by employment of gas jet, which in non-compressing engines is drawn directly into the explosive mixture contained by the cylinder. But in compressing engines it is drawn first into a chamber containing the combustible mixture, at atmospheric pressure, which is closed to the external air and then opened toward the cylinder, so as to communicate flame to the contents of the cylinder. 6. What size vacuum for one horse power? A. We do not understand what you mean by vacuum. 7. Does the patent on gas engines cover the manner of using gas and air only, or does it cover the combination of gas and air as a motive power? A. There are methods of using gas and air in gas engines which are not patented. There are other methods which are patented. The broad idea of generating power by the explosion of gas in a cylinder is not patented, and is public property.

(49) E. A. A.—You will find a description of the Bell telephone in SUPPLEMENT, No. 142. If an ordinary acoustic telephone would answer your purpose, you can readily make one by connecting with the ends of a light wire cable line, cigar boxes, which will answer very well as transmitters and receivers.

(50) C. P. W. asks: 1. Will you explain the point of saturation in permanent magnets? A. The point of saturation in a permanent magnet is reached when the magnet becomes incapable of permanently retaining as much magnetism as the strongest helix or electro magnet can impart to it. 2. How powerful in proportion to their own weight can they be made? Can they support more than their own weight? If so, how much? A. They have been made to lift 15 times their own weight, and small magnets have been made which would lift 25 times their own weight. 3. What is the longest distance they will attract, say chrome steel? A. As the attracting power of a magnet is inversely as the square of the distance, of course its power rapidly diminishes with the distance, so that the strongest magnot does not have any considerable power except in the immediate vicinity of its poles. 4. What kind of steel will make the best and strongest magnets? A. Chrome steel is said to be the best.

(51) T. R. G.—The office of the large wire in an induction coil is to produce intense magnetism in the core of the coil. There is no very well established relation between the primary and secondary coil, except that the primary coil should be capable of producing a magnetic field which will extend to the exterior of the secondary coil. You will find full description of induction coil in SUPPLEMENT, No. 160.

(52) N. J. W. writes: I have made a small dynamo after SUPPLEMENT, No. 161, that magnetizes electro magnets powerfully, and makes quite a light between a carbon and platinum point, but will not run one 3 candle power incandescent lamp. Has any one succeeded in making it run a 3 candle power incandescent lamp? A. You ought to be able to operate a three candle power incandescent lamp of lower resistance with the current from your dynamo. 2. In making a new armature having 4 coils, shall I use the same size wire, or would finer wire be better? A. In making your new armature, by employing finer wire, say No. 24, you will be able to produce a current of higher tension, which will work through greater resistance than the current from your present machine.

(53) E. R. S.—It would be impossible to give offhand the information you desire concerning the construction of the dynamo. The development of a dynamo of a new size or form requires a great deal of calculation, as well as much experiment. You had better consult some competent electrical engineer for the information you desire.—For a cement for fastening rubber to iron, melt together equal parts of pitch, gutta percha, and shellac. Apply the cement to the iron while the iron is warm.

(54) J. S. C. writes: If a barrel of oil (crude or refined) was say 30 feet from a stove, and there was ¼ or ½ inch pipe running from the barrel into the stove, and if I would turn on the oil (in a spray) and light it, would it burn only at the end of the pipe (in the stove), or would the fire follow the pipe to the barrel and cause it to explode? A. If the spray were kept up under considerable pressure, the fire could not run back into the barrel. You can avoid danger of explosion by extending your spray pipe to the bottom of the barrel, so that it will always be covered with oil.

(55) H. H.—Dynamite, as is the case with other explosives, expands with equal force in all directions.

(56) G. S.—The solder you refer to as being applied so easily is probably what is called bismuth solder, and is made of two parts of tin and one part each of lead and bismuth, by weight. It makes a very easy flowing solder.

(57) E. N.—The steam from the top or outlet of your coil boiler should not pass directly to engine, but to a chamber, so that the water will be separated from the steam, and settle to the bottom of the coil through a direct pipe connection. An old locomotive boiler, tested hydrostatically to 140 pounds, should not be trusted with more than 75 pounds steam pressure.

(58) Z. L. asks for the proportions of metals used in bronze castings. A. Red bronze: copper, 87; zinc, 13—yellow bronze: copper, 67; zinc, 31; tin, 2—statuary bronze: copper, 91; zinc, 5; tin, 2; lead, 2.

(59) G. W. L.—The Babcock fire extinguisher is charged with a solution of bicarbonate of soda in water and sulphuric acid in a lead bottle, which, when required, is turned over by a crank, spilling the acid into the charge of soda water. Carbonic acid gas is instantly generated, by which a pressure is obtained sufficient for throwing the whole contents of the apparatus with much force through a nozzle for fire purposes. Use of sulphuric acid 5 parts, bicarbonate of soda 6 parts, by weight. Other combinations are used, such as carbonate of ammonia, potash, etc. Iron can be used for the alkaline reservoirs. There are about 20 patents for fire extinguishers, mostly on the mechanical details.

(60) E. C. B. asks: Will coal oil saponify by uniting with any alkali, and is it ever used in the manufacture of soap? A. Yes, petroleum soap is in the New York markets.

(61) A. A.—For giving to cast zinc a genuine brass color, use for your dipping bath, for each quart of water, one-fifth ounce sulphate of copper, one-fifth ounce protochloride of tin. You may vary the shades by varying the proportions of the salts.

(62) G. W.—The following are dipping baths suitable for bird cages: nitric acid, 2 parts; sulphuric acid, 4 parts—or, sulphuric acid, 6 parts; nitric acid, 1 part; muriatic acid, 1 part; all by measure.

(63) R. M. H. asks the power necessary to overcome the resistance of a large horse street car on a *level* track, loaded with 50 persons. Also, to move the same loaded car up an incline represented by an angle of 10 degrees? A. For car on a level track, about 60 lb.; on an ascent of 10 degrees, 1,300 lb. To obtain an initial momentum will probably require far more, according to how near a perfect balance it is on which the car is resting, involving inequalities in axles, wheels, track, etc.

(64) P. M. L.—Pin points are supposed to be finished with a fine emery wheel revolving in the machine that makes the pin. You may put the points on pin tongues in a small way by twirling the points between the thumb and finger, upon a fine emery wheel running at high speed.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined with the results stated.

E. M.—No. 1 is a fine grained so-called micaceous hematite or specular iron ore. It has no value as a paint in this city. The color is not considered good. No. 2 is simply a large grain or crystal of the specular iron ore. The ore, if free from sulphur and phosphorus, might be valuable for the iron. An analysis would be necessary to determine this.

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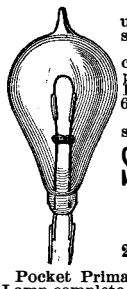

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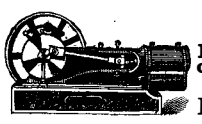
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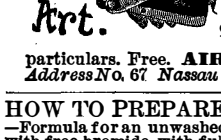

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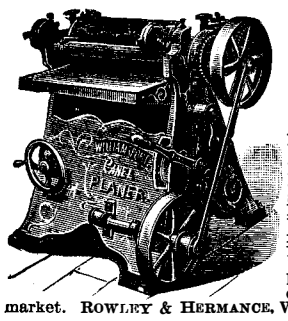

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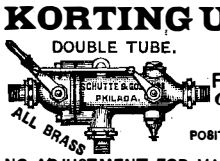

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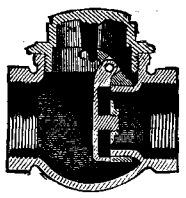

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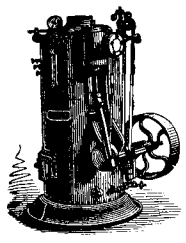

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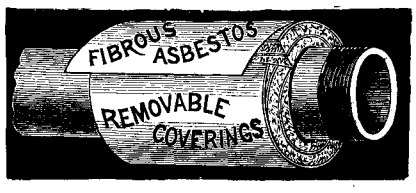

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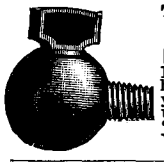

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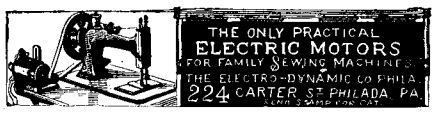

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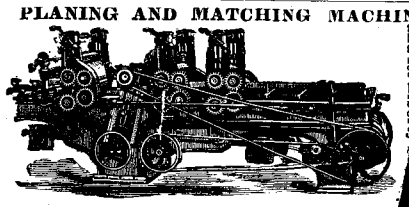

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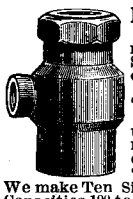

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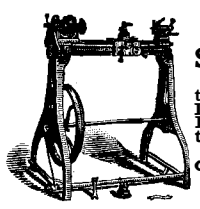

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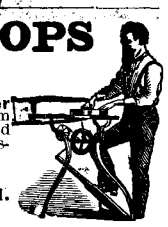

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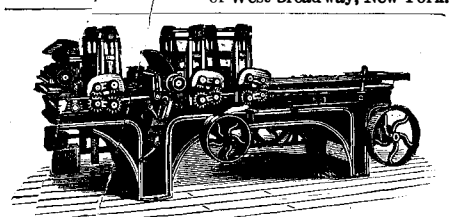

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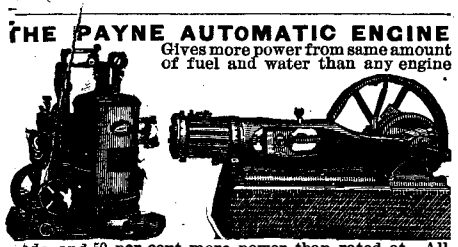

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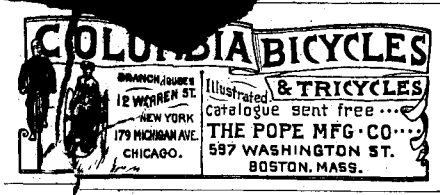

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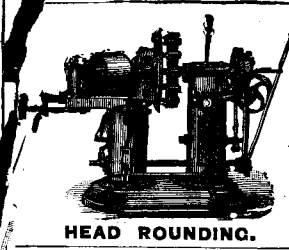

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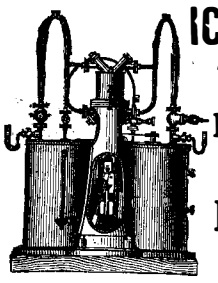

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